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The complete dictionary of arts and sciences

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THE COMPLETE

DICTIONARY

OF

ARTS and SCIENCES.

IN WHICH THE WHOLE CIRCLE OF

HUMAN LEARNING

IS EXPLAINED,

And the DIFFICULTIES attending the Acquisition of EVERY ART,
Whether LIBERAL or MECHANICAL, are Removed,

IN THE MOST EASY AND FAMILIAR MANNER.

Among the various Branches of LITERATURE explained in this WORK are the following, viz.

AGRICULTURE	ETHICS	HYDROGRAPHY	PAINTING
ALGEBRA	FLUXIONS	HYDROSTATICS	PERSPECTIVE
ANATOMY	FORTIFICATION	LAW	PHARMACY
ARCHITECTURE	GARDENING	LEVELLING	PHILOLOGY
ARITHMETIC	GAUGING	LOGIC	PHILOSOPHY
ASTRONOMY	GEOGRAPHY	MARITIME AND	PHYSIC
BOTANY	GEOMETRY	MILITARY AFFAIRS	PNEUMATICS
CATOPTRICS	GRAMMAR	MATHEMATICS	RHETORIC
CHEMISTRY	GUNNERY	MECHANICS	SCULPTURE
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The Rev. TEMPLE HENRY CROKER, A. M.

Chaplain to the Right Honourable the Earl of HILLSBOROUGH.

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Author of an Eafy Introduction to the Theory and Practice of Mechanics.

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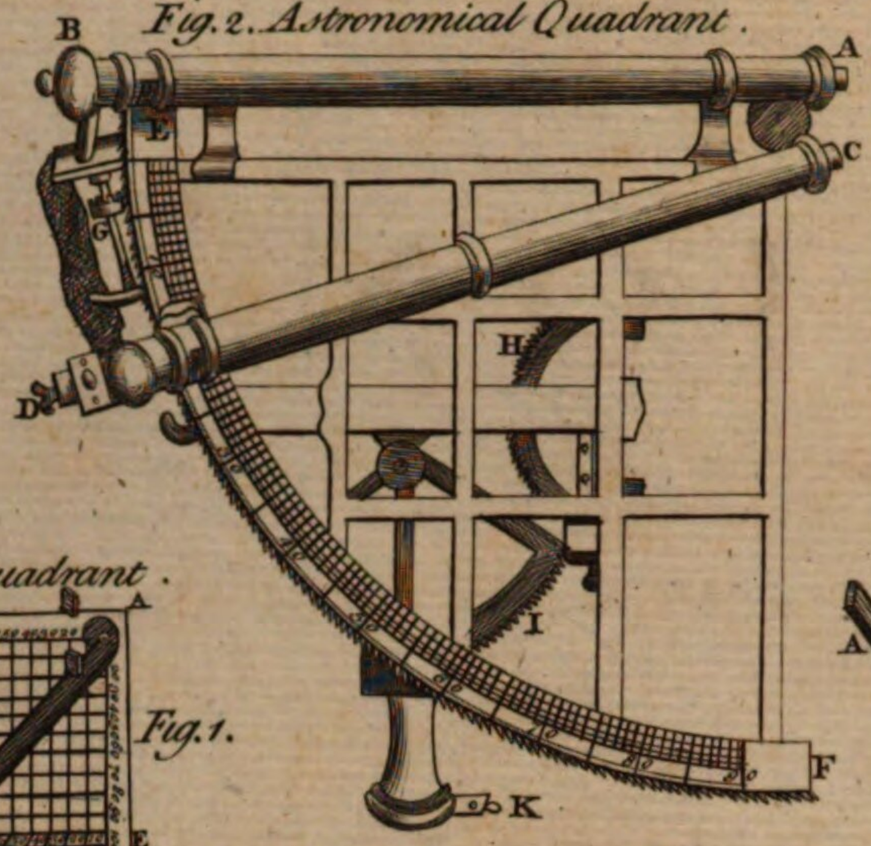
Fig. 2. Astronomical Quadrant.



The Common Quadrant.

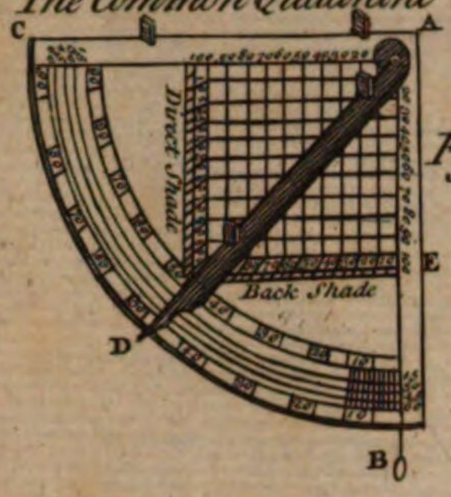
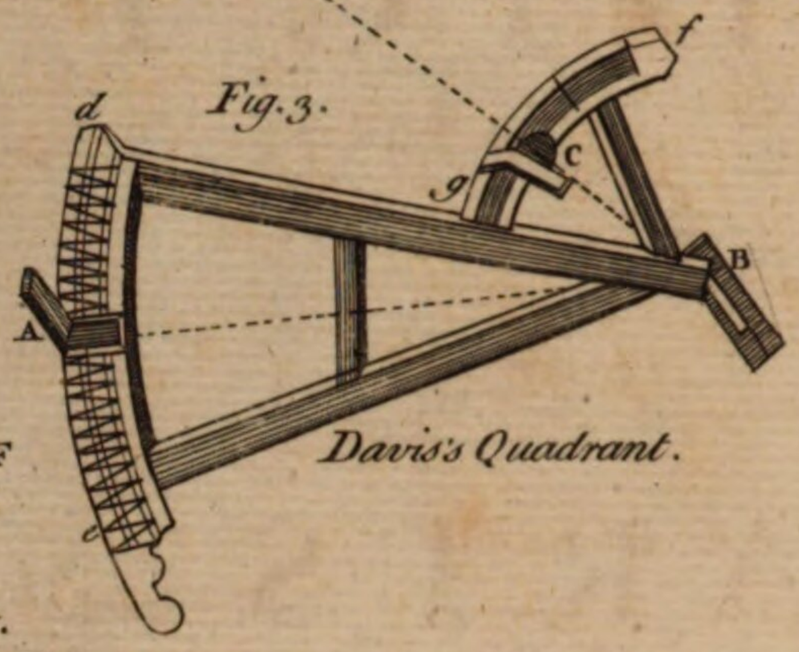


Fig. 1.

Fig. 3.



Davis's Quadrant.

Gunner's Quadrant.

Fig. 8.

Fig. 7. The Sinical Quadrant.

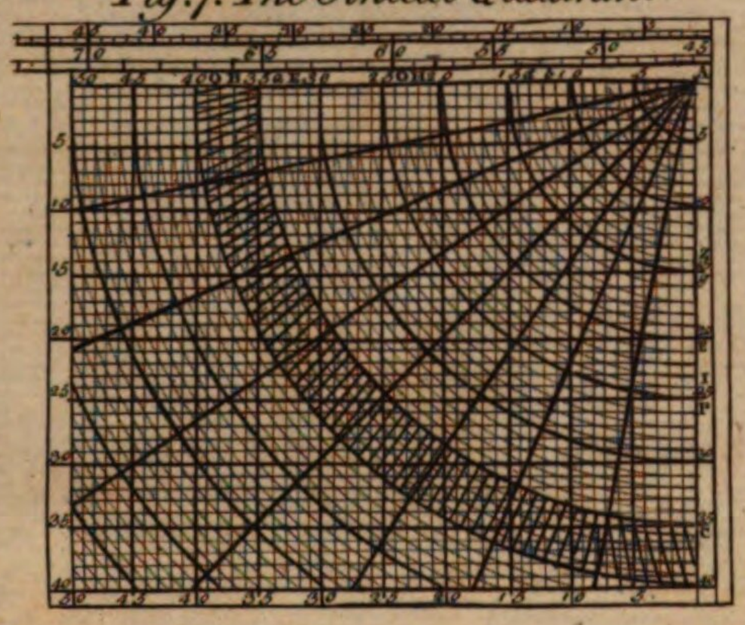
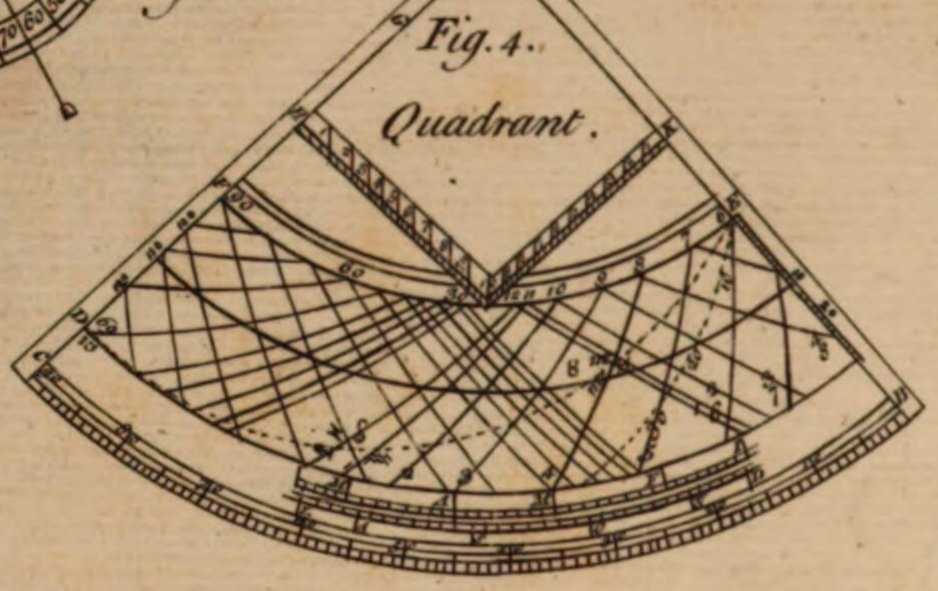


Fig. 4. Quadrant.



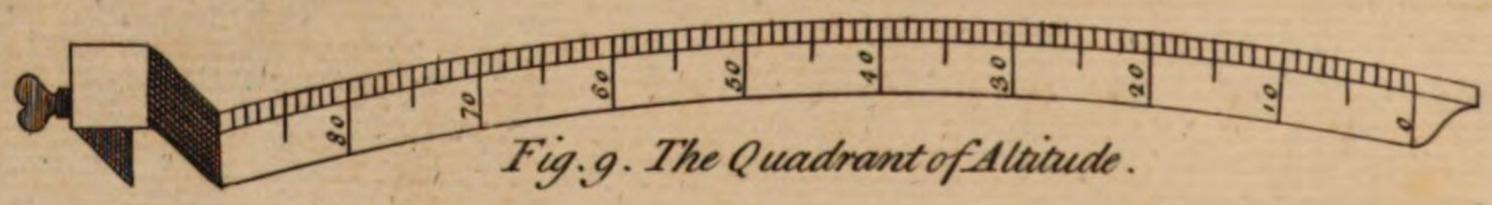
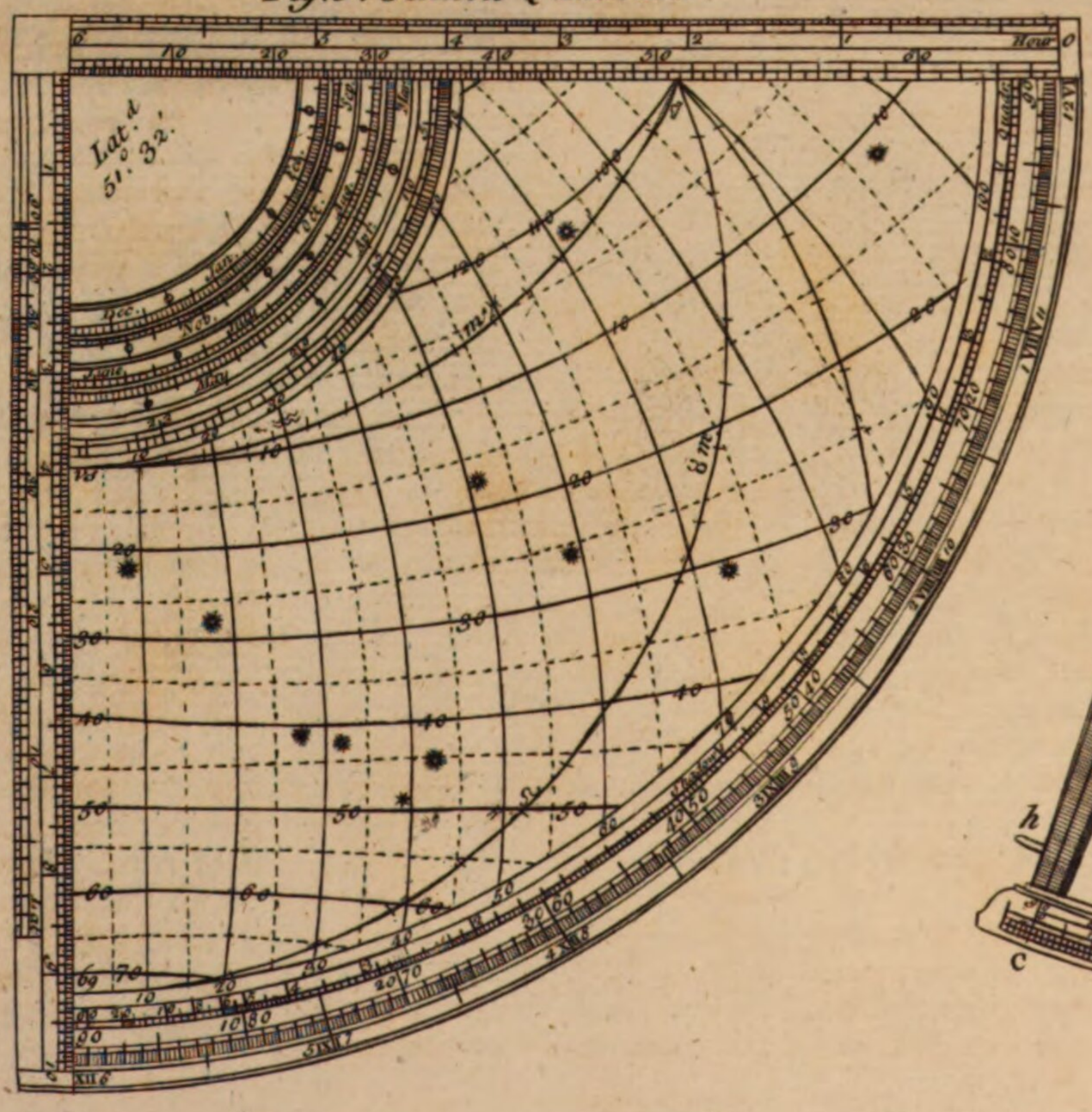


Fig. 9. The Quadrant of Altitude.

Fig. 6. Sutton's Quadrant.



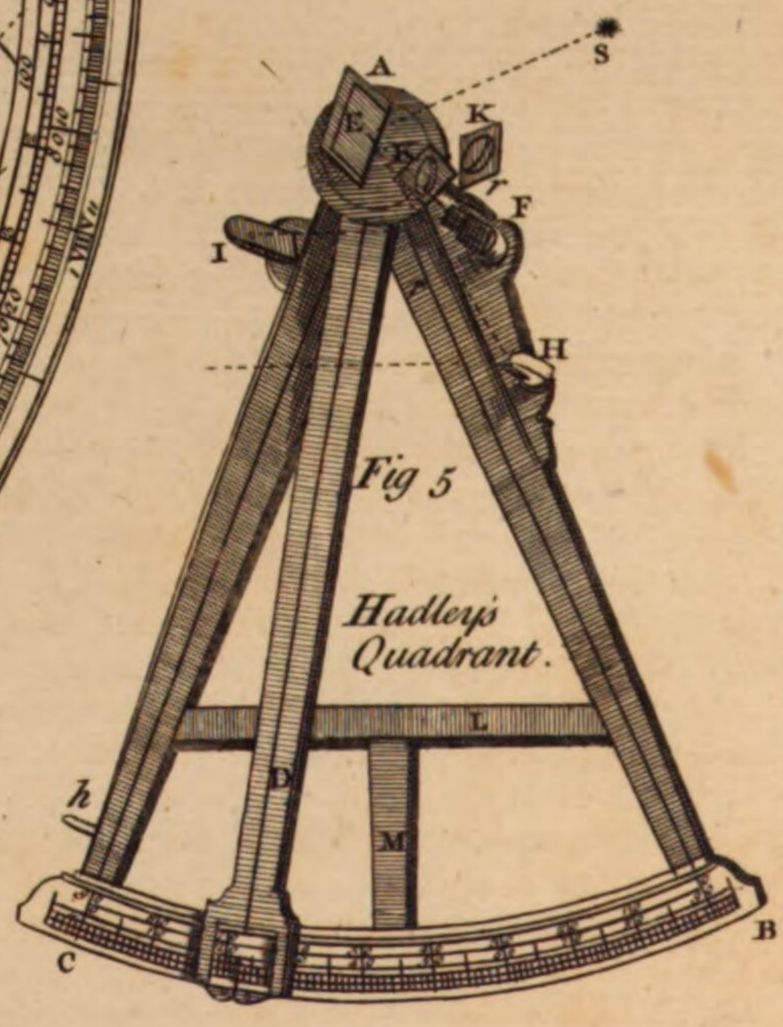


Fig 5

Hadley's Quadrant.

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QUA

Q, a conſonant, and the ſixteenth letter of the alphabet, and, though it is not in the old Greek or Latin alphabet, is yet derived from the more ancient Hebrew ϒ, by turning the character and making the angular apex round, and carrying the perpendicular part obliquely under the round one; and from thence alſo the modern Hebrew character ק koph of the ſame letter. In the Latin, the uſe or diſuſe of the Q ſeems to have been ſo little ſettled, that the poets uſed the Q or C indifferently, as beſt ſuited their meaſures; it being a rule, that the C imported them to be divided. The Saxons had not this letter, but expreſſed it by *c p*, as in *cpacian*, to quake, &c.

In the French, the ſound of the Q and K are ſo near akin, that ſome of their niceſt authors think the former might be ſpared.

In Engliſh, the Q is formed in the voice in a different manner from K, the cheeks being contracted, and the lips, eſpecially the under one, put into a cannular form for the paſſage of the breath. It is, however, never ſounded alone, but in conjunction with *u* after it either in Latin or Engliſh, as in *qualis*, *quantum*, *qualm*, *queen*, *oblique*, &c. and it never ends any Engliſh word.

As a numeral, Q ſtands for 500; and with a daſh over it, thus $\bar{Q}$, for 500000.

Uſed as an abbreviature, *q* ſignifies *quantity* or *quantum*: thus, among phyſicians, *q. pl.* is *quantum placet*, that is, as much as you pleaſe of a thing; and *q. ſ. quantum ſufficit*, that is, as much as is neceſſary. *Q. E. D.* among mathematicians is *quod erat demonſtrandum*, that is, which was to be demonſtrated; and *Q. E. F. quod erat faciendum*, that is, which was to be done. Q. D. among grammarians, is *quaſi dictum*, that is, as if it were ſaid, or, as who ſhould ſay.

QUACK, among phyſicians, the ſame with empiric. See the article EMPIRIC.

QUADRA, in building, any ſquare border encompaſſing a baſſo relievo, pannel, painting, or other work.

QUADRAGESIMA, a denomination given to Lent, from its conſiſting of forty days. See the article LENT.

QUA

Hence alſo the firſt Sunday of Lent is called Quadrageſima Sunday, and the three preceding Sundays, Quinquageſima, Sexageſima, and Septuageſima.

QUADRANGLE, in geometry, the ſame with quadrilateral figure, or one conſiſting of four ſides and four angles. See QUADRILATERAL.

QUADRANT, QUADRANS, in geometry, an arch of a circle, containing 90°, or one fourth part of the whole periphery. The ſpace or area included between this arch and two radii drawn from the center, to each extremity thereof, is called a quadrant, or, more properly, a quadrantal ſpace, as being a quarter of an entire circle.

QUADRANT alſo denotes a mathematical inſtrument, of great uſe in aſtronomy, navigation, &c. for taking of altitudes, angles, &c. It is variouſly contrived, according to the various uſes it is intended for, but they all have this in common, that they conſiſt of a quarter of a circle, whoſe limb is divided into 90°: ſome have a plummet ſuſpended from the center, and furniſhed with pinnulæ or ſights to look through.

The principal and moſt uſeful quadrants are the common or ſurveying quadrant, aſtronomical quadrant, Davis's quadrant, Hadley's quadrant, horodictical quadrant, Gunter's quadrant, Sutton's or Collins's quadrant, and the ſinical quadrant.

1. The common or ſurveying quadrant, (plate CVII. *fig.* 1.) is made of braſs, wood, or any other ſolid ſubſtance; the limb of which is divided into 90°, and each of theſe farther divided into as many equal parts as the ſpace will allow, either diagonally or otherwiſe. On one of the ſemi-diameters are fitted two moveable ſights, and to the center is ſometimes alſo fixed a label, or moveable index, bearing two other ſights; but in lieu of theſe laſt ſights there is ſometimes fitted a teleſcope; alſo from the center there is hung a thread with a plummet; and on the under ſide, or face of the inſtrument is fitted a ball and ſocket, by means of which it may be put into any poſition. The general uſe of it is for taking angles in a vertical plane, comprehended under right lines going from the center of the inſtrument, one of which is horizontal,

and the other is directed to ſome viſible point. But beſides the parts already deſcribed, there is frequently added on the face near the center, a kind of compartment, called the quadrat, or geometrical ſquare; as in the figure.

This quadrant may be uſed in different ſituations: for obſerving heights or depths, its plane muſt be diſpoſed perpendicularly to the horizon; but to take horizontal diſtances, its plane is diſpoſed parallel thereto: again, heights and diſtances may be taken two ways, viz. by means of the fixed ſights and plummet, or by the label.

Uſe of the Surveying QUADRANT.—To take the height or depth of an object, with the fixed ſights and plummet, place the quadrant vertically, and the eye under the ſight next the arch of the quadrant; thus direct the inſtrument to the object, ſuppoſe the top of a caſtle, &c. till the viſual rays thereof ſtrike through the ſights upon the eye.

This done, the portion of the arch intercepted between the thread and the ſemi-diameter, whereon the ſights are faſtened, ſhews the complement of the object's height above the horizon or its diſtance from the zenith; and the other portion of the arch, between the thread and the other ſemi-diameter, ſhews the height itſelf of the object above the horizon. The ſame arch likewiſe gives the quantity of the angle made by the viſual ray, and a horizontal line parallel to the baſe of the tower. To obſerve depths, the eye muſt be placed over that ſight next the center of the quadrant.

From the height or depth of the object, in degrees thus found, which ſuppoſe 35° 35′; and the diſtance of the foot of the object from the place of obſervation carefully meaſured, which ſuppoſe 47 feet; its height or depth in feet, yards, &c. is eaſily determined by the moſt common caſe in trigonometry.

For we have here in a triangle one ſide given; namely the line meaſured, and we have all the angles; for that of the caſtle is always ſuppoſed a right angle; the other two, therefore, are equal to another right angle; but the angle obſerved is 35°, 35′, therefore, the other is 54°, 25′.

The caſe then will be reduced to this: as the ſine of 54°, 25′, is to 47 feet; ſo is the ſine of 35°, 35′, to a fourth term thirty-three feet and a half; to which add the height of the obſerver's eye, ſuppoſe five feet, the ſum thirty-eight feet and a half is the height of the caſtle required.

As to the taking of altitudes of objects acceſſible, or inacceſſible, ſee ALTITUDE.

2. *Aſtronomical* QUADRANT, is an inſtrument contrived to take the altitude, &c. of the heavenly bodies in a very accurate manner.

This inſtrument is generally made of braſs, or wooden bars faced with plates of iron, having its limb *fe* (*fig.* 2.) divided either diagonally or otherwiſe into degrees, minutes, and ſeconds, if poſſible, with two teleſcopes; one fixed on the ſide of it, as *a b*, and the other *c d* moveable upon the center, by means of the ſcrew *g*. And by means of ſcrews and the dented wheels *h*, *i*, together with the ſcrew *b*, it is eaſily directed to any object, or phœnomenon.

3. *Davis's* QUADRANT, ſo called from its inventor captain Davis; and is no other than a common quadrant, leſſened in one part of the arch, by ſuppoſing it to be divided into two different arches by a concentric circle, whereby the inſtrument becomes more portable.

It conſiſts of two arches, and three vanes. See (*fig.* 3.) The arch *f g* contains commonly 60 deg. whence it is generally called the ſixty arch, and is numbered from *f* towards *g*. The other arch *d e* contains 30 degrees, or the complement of the former, being numbered from *e* towards *d*. On the ſurface of this arch are deſcribed 12 concentric circles, whereby each deg. by the help of diagonal lines, is divided into 12 equal parts, and conſequently the altitude may be obtained to 5 minutes. The ſight vane A is a piece of wood or braſs, of about three inches long and one broad, and is fitted to ſlide on the arch *d e*; in the middle of this vane is drilled a fine hole, through which both the ſolar ſpot, or ſhadow, and horizon are to be viewed at the time of obſervation. The horizon vane B is of about the ſame length and breadth as the former; and at the time of obſervation is fixed at B; it has a ſlit cut through it of about an inch long, and a quarter of an inch broad, through which the horizon is to be obſerved. The ſhade vane C is fitted to the arch *d e*, and has generally a convex lens ſet therein, which caſts the ſolar ſpot on the horizon vane at the time of obſervation, being one of the many inventions of the celebrated Mr. Flamſteed.

To find the ſun's altitude by this inſtrument: fix the ſhade vane C on the 60° arch, at about 15 or twenty degrees leſs than the complement of the altitude, and turning your back towards the ſun, move the ſight vane A up and down the arch *d e*, till the ſun's image fall on the horizon vane B, and at the ſame inſtant you ſee the horizon through the ſlit in the horizon vane; then will the degrees cut by the ſhade vane C, on the arch *f g*, being added to thoſe cut by the ſight vane A, on the arch *d e*, be the ſun's zenith diſtance at that time, which being ſubtracted from 90 degrees, will give his altitude.

But to obtain the ſun's greateſt altitude, or altitude when he is in the meridian, which is required in finding the latitude, continue obſerving, and as the ſun approaches the meridian, the ſea will appear through the ſlit in the horizon vane, and then muſt the ſlit vane be removed lower. And thus continue obſerving, till the ſun be in the meridian, and, as ſoon as he begins to decline, the ſky will appear thro' the ſlit in the horizon vane, when your obſervation will be finiſhed, and the degrees on the ſixty arch being added to thoſe on the thirty arch will give the complement of the ſun's meridian altitude or zenith diſtance, as before.

4. *Gunter's* QUADRANT, ſo called from its inventor Edmund Gunter, is repreſented in plate CVII. *fig.* 4. and beſides the apparatus of other quadrants, has a ſtereographical projection of the ſphere on the plane of the equinoctial. It has alſo a calendar of the months, next to the diviſions of the limb.

Uſe of Gunter's QUADRANT. 1. To find the ſun's meridian altitude for any given day, or the day of the month for any given meridian altitude. Lay the thread to the day of the month in the ſcale next the limb; and the deg. it cuts in the limb, is the ſun's meridian altitude. Thus the thread being laid on the 15th of May cuts 59° 30′, the altitude ſought; and contrarily the thread, being ſet to the meridian altitude, ſhews the day of the month. 2. To find the hour of the day. Having put the bead, which ſlides on the thread, to the ſun's place in the ecliptic, obſerve the ſun's altitude by the quadrant; then, if the thread be laid over the ſame in the limb, the bead will fall upon the hour required. Thus ſuppoſe on the 10th of April, the ſun being then in the beginning of Taurus, I obſerve the ſun's altitude by the quadrant to be 36°; I place the bead to the beginning of Taurus in the ecliptic, and lay the thread over 36° of the limb; and find the bead to fall on the hour-line marked 3 and 9; accordingly the hour is either 9 in the morning, or 3 in the afternoon. Again, laying the bead on the hour given, having firſt rectified, or put it to the ſun's place, the degree cut by the thread on the limb gives the altitude. Note, the bead may be rectified otherwiſe, by bringing the thread to the day of the month, and the bead to the hour-line of 12. 3. To find the ſun's declination from his place given, and contrariwiſe. Set the bead to the ſun's place in the ecliptic, move the thread to the line of declination E T, and the bead will cut the degree of declination required. Contrarily, the bead being adjuſted to a given declination, and the thread moved to the ecliptic, the bead will cut the ſun's place. 4. The ſun's place being given, to find his right aſcenſion, or contrarily. Lay the thread on the ſun's place in the ecliptic, and the degree it cuts on the limb is the right aſcenſion ſought. Contrarily, laying the thread on the right aſcenſion, it cuts the ſun's place in the ecliptic. 5. The ſun's altitude being given, to find his azimuth, and contrariwiſe. Rectify the bead for the time, as in the ſecond article, and obſerve the ſun's altitude; bring the thread to the complement of that altitude; thus the bead will give the azimuth ſought among the azimuth lines. 6. To find the hour of the night from ſome of the five ſtars laid down on the quadrant. 1. Put the bead to the ſtar you would obſerve, and find how many hours it is off the meridian, by article 2. Then, from the right aſcenſion of the ſtar ſubſtract the ſun's right aſcenſion converted into hours,

and

and mark the difference: which difference, added to the obſerved hour of the ſtar from the meridian, ſhews how many hours the ſun is gone from the meridian, which is the hour of the night. Suppoſe on the 15th of May the ſun is in the 4th degree of Gemini, I ſet the bead to Arcturus; and, obſerving his altitude, find him to be in the weſt about 52° high, and the bead to fall on the hour-line of 2 in the afternoon; then will the hour be 11 hours 50 minutes paſt noon, or 10 minutes ſhort of midnight: for 62°, the ſun's right aſcenſion, converted into time, make 4 hours 8 minutes, which ſubtracted from 13 hours 58 minutes, the right aſcenſion of Arcturus, the remainder will be 9 hours 50 minutes, which added to 2 hours, the obſerved diſtance of Arcturus from the meridian, ſhews the hour of the night to be 11 hours 50 minutes.

Hadley's QUADRANT, the moſt uſeful inſtrument for taking altitudes at ſea, yet extant. It has its name from its inventor, J. Hadley, Eſq; and is compounded of the following particulars. 1. An octant, or $\frac{1}{8}$ part of a circle, A B C. 2. An index D. 3. The ſpeculum E. 4. Two horizontal glaſſes, F, G. 5. Two ſcreens, K, K. 6. Two ſight-vanes, H, I. plate CVII. *fig.* 5.

The octant conſiſts of two radii, A B, A C, which are ſtrengthened by the braces L, M, and the arch B C; which though containing only 45°, is nevertheleſs divided into 90 primary diviſions, each of which ſtands for degrees, and are numbered 0, 10, 20, 30, &c. to 90; beginning at each end of the arch, for the convenience of numbering both ways, either for altitudes or zenith-diſtances: again, each degree is ſubdivided into minutes.

The index D, is a flat bar, moveable round the center of the inſtrument; and that part of it which ſlides over the graduated arch, B C, is open in the middle, with Vernier's ſcale on the lower part of it; and underneath is a ſcrew, ſerving to faſten the index againſt any diviſion.

The ſpeculum E, is a piece of flat glaſs, quickſilvered on one ſide, ſet in a braſs-box, and placed perpendicular to the plane of the inſtrument, the middle part of the former coinciding with the center of the latter. And, becauſe the ſpeculum is fixed to the index, the poſition of it will be altered by the moving of the index along the arch. The rays of an obſerved object are received on the ſpeculum, and from thence reflected on one of the horizon glaſſes F G, which are two ſmall pieces of looking-glaſs placed on one of the limbs, their faces being turned obliquely to the ſpeculum, from whence they receive the reflected rays of obſerved objects. This glaſs, F, has only its lower part quickſilvered, and ſet in brass-work; the upper part being left tranſparent to view the horizon. The glaſs G has in its middle a tranſparent ſlit, through which the horizon is to be ſeen. And becauſe the warping of the wood-work, and other accidents, may diſtend them from their true ſituation, there are three ſcrews paſſing thro' their feet, whereby they may be eaſily replaced. The ſcreens are two pieces of coloured glaſs, ſet in two ſquare braſs frames K, K, which ſerve as ſcreens to take off the glare of the ſun's rays, which would be otherwiſe too ſtrong for the eye; the one is tinged much deeper than the other, and, as both of them move on the ſame center, they may be both or either of them uſed: in the ſituation they appear in the figure, they ſerve for the horizon-glaſs F; but, when they are wanted for the horizon-glaſs G, they muſt be taken from their preſent ſituation, and placed on the quadrant above G.

The ſight vanes are two pins, H and I, ſtanding at right angles to the plane of the inſtrument; that at H has one hole in it, oppoſite to the tranſparent ſlit in the horizon-glaſs G; the other, at I, has two holes in it, the one oppoſite to the middle of the tranſparent part of the horizon-glaſs F, the other rather lower than the quickſilvered part: this vane has a piece of braſs on the back of it, which moves round a center, and ſerves to cover either of the holes.

There are two ſorts of obſervations to be made with this inſtrument; the one, when the back of the obſerver is turned towards the object, and therefore called the back-obſervation; the other, when the face of the obſerver is towards the object, which is called the fore-obſervation. To rectify the inſtrument for the fore-obſervation: ſlacken the ſcrew in the middle of the handle behind the glaſs F; bring the index cloſe to the button *b*; hold the inſtrument in a vertical poſition, with the arch downwards; look through the right hand hole in the vane I, and through the tranſparent part of the glaſs F, for the horizon; and if it lies in the ſame right line with the image of the horizon, ſeen on the quickſilvered part, the glaſs F is rightly adjuſted; but, if the two horizon-lines diſagree, turn the ſcrew at the end of the handle backwards or forwards, until thoſe lines coincide, then faſten the middle ſcrew of the handle, and the glaſs is rightly adjuſted.

To take the ſun's altitude by the fore-obſervation: having fixed the ſcreens above the horizon-glaſs F, and ſuited them proportionally to the ſtrength of the ſun's rays, turn your face towards the ſun, holding the inſtrument with your right hand, by the braces L, M, in a vertical poſition, with the arch downwards; put your eye cloſe to the right hand hole in the vane I, and view the horizon through the tranſparent part of the horizon-glaſs F, moving at the ſame time the index D, with your left hand, till the reflex ſolar ſpot coincides with the line of the horizon; then the degrees counted from C, or that end next your body, will give the altitude of the ſun at that time, obſerving to add or ſubtract 16 min. according as the upper or lower edge of the ſun's reflex image is made uſe of. But to obtain the ſun's meridian altitude, which is the thing wanted, in order to find the latitude; the obſervations muſt be continued, and, as the ſun approaches the meridian, the index D muſt be continually moved towards B, in order to maintain the coincidence between the reflex ſolar ſpot and the horizon; and conſequently, as long as this motion can maintain the ſame coincidence, the obſervation muſt be continued, and when the ſun has attained the meridian, and begins to deſcend, the coincidence will require a retrograde motion of the index, or towards C; and then is the obſervation finiſhed, and the degrees counted, as before, will give the ſun's meridian altitude, or thoſe from B, the zenith-diſtance.

6. *Sutton*'s, ſometimes called *Collins's Pocket* QUADRANT, as repreſented *fig.* 6. is a ſtereographic projection of one quarter of the ſphere, between the tropics, upon the plane of the ecliptic, the eye being in its north pole; it is fitted to the latitude of London. The lines, running from the right hand to the left, are parallels of altitude; and thoſe croſſing them are azimuths. The leſſer of the two circles, bounding the projection, is one fourth of the tropic of Capricorn; the greater is one fourth of that of Cancer. The two ecliptics are drawn from a point on the left edge of the quadrant, with the characters of the ſigns upon them; and the two horizons are drawn from the ſame point. The limb is divided both into degrees and time; and, by having the ſun's altitude, the hour of the day may be found here to a minute.

The quadrantal arches next the center contain the calendar of months; and under them, in another arch, is the ſun's declination.

On the projection are placed ſeveral of the moſt noted fixed ſtars between the tropics; and the next below the projection is the quadrant and line of ſhadows.

To find the time of the ſun's riſing or ſetting, his amplitude, his azimuth, hour of the day, &c. by this quadrant: lay the thread over the day and the month, and bring the bead to the proper ecliptic, either of ſummer or winter, according to the ſeaſon, which is called rectifying; then, moving the thread, bring the bead to the horizon, in which caſe the thread will cut the limb in the time of the ſun's riſing or ſetting, before or after ſix; and at the ſame time the bead will cut the horizon in the degrees of the ſun's amplitude.

Again, obſerving the ſun's altitude with the quadrant, and ſuppoſing it found 45° on the 5th of May, lay the thread over the fifth of May, bring the bead to the ſummer ecliptic, and carry it to the parallel of altitude 45°, in which caſe the thread will cut the limb at 55° 15′, and the hour will be ſeen among the hour-lines to be either 41′ paſt nine in the morning, or 19′ paſt two in the afternoon.

Laſtly, the bead among the azimuths ſhews the ſun's diſtance from the ſouth 50° 41′.

But note, that if the ſun's altitude be leſs than what it is at ſix o'clock, the operation muſt be performed among thoſe parallels above the upper horizon; the bead being rectified to the winter ecliptic.

7. *Sinical* QUADRANT (*fig.* 7) conſiſts of ſeveral concentric quadrantal arches, divided into eight equal parts by radii, with parallel right lines croſſing each other at right angles.

Now any one of the arches, as B C, may repreſent a quadrant of any great circle of the ſphere, but is chiefly uſed for the horizon or meridian. If then B C be taken for a quadrant of the horizon, either of the ſides, as A B, may repreſent the meridian; and the other ſide, A C, will repreſent a parallel, or line of eaſt and weſt: and all the other lines, parallel to A B, will alſo be meridians; and all thoſe parallel to A C, eaſt and weſt lines or parallels.

Again, the eight ſpaces into which the arches are divided by the radii, repreſent the eight points of the compaſs in a quarter of the horizon; each containing 11° 15′.

The arch B C, is likewiſe divided into 90°, and each degree ſubdivided into 12′, diagonal-wiſe.

To the center is fixed a thread, which, being laid over any degree of the quadrant, ſerves to divide the horizon

If the ſinical quadrant be taken for a fourth part of the meridian, one ſide thereof, A B, may be taken for the common radius of the meridian and equator; and then the other, A C, will be half the axis of the world. The degrees of the circumference, B C, will repreſent degrees of latitude, and the parellels to the ſide A B, aſſumed from every point of latitude to the axis A C, will be radii of the parallels of latitude, as likewiſe the ſine complement of thoſe latitudes.

Suppoſe then it be required to find the degrees of longitude contained in 83 of the leſſer leagues, in the parallel of 48°; lay the thread over 48° of latitude on the circumference, and count thence the 83 leagues, on A B beginning at A; this will terminate in H, allowing every ſmall interval 4 leagues. Then tracing out the parallel H E, from the point H to the thread; the part A E of the thread ſhews that 125 greater or equinoctial leagues make 6° 15′; and therefore that the 83 leſſer leagues A H, which make the difference of longitude of the courſe, and are equal to the radius of the parallel H E, make 6° 15′ of the ſaid parallel.

If the ſhip ſails an oblique courſe, ſuch courſe, beſides the north and ſouth greater leagues, gives leſſer leagues eaſterly and weſterly, to be reduced to degrees of longitude of the equator. But theſe leagues being made neither on the parallel of departure, nor on that of arrival, but in all the intermediate ones; we muſt find a mean proportional parallel between them.

To find this, we have on the inſtrument a ſcale of croſs latitudes. Suppoſe then it were required to find a mean parallel between the parallels of 40° and 60°; with your compaſſes take the middle between the 40th and 60th degree on the ſcale; this middle point will terminate againſt the 51ſt degree, which is the mean parallel required.

The principal uſe of the ſinical quadrant is to form triangles upon, ſimilar to thoſe made by a ſhip's way, with the meridians and parallels; the ſides of which triangles are meaſured by the equal intervals between the concentric quadrants, and the lines N and S. E and W; and every fifth line and arch is made deeper than the reſt.

Now ſuppoſe a ſhip to have ſailed 150 leagues north-eaſt, one fourth north, which is the third point, and makes an angle of 33° 45′ with the north-part of the meridian: here are given the courſe and diſtance ſailed, by which a triangle may be formed on the inſtrument, ſimilar to that made by the ſhip's courſe; and hence the unknown parts of the triangle may be found. Thus ſuppoſing the center A to repreſent the place of departure; count, by means of the concentric circles, along the point the ſhip ſailed on, viz. A D, 150 leagues from A to D; then is the point D the place the ſhip is arrived at, which note. This done, let D E be parallel to the ſide; and then there will be formed a right-angled triangle A E D, ſimilar to that of the ſhip's courſe difference of longitude and latitude: the ſide A E gives 125 leagues for the difference of the latitude northwards, which makes 6° 15′; and the ſide D E gives 83 leſſer leagues anſwering to the parallels, which, being reduced as ſhewn above, gives the difference of the longitude. And thus is the whole triangle formed.

8. *Gunner's* QUADRANT (*fig.* 8.) ſometimes called gunner's ſquare, is that uſed for elevating and pointing cannon, mortars, &c. and conſiſts of two branches either of braſs or wood, between which is a quadrantal arch divided into 90°, beginning from the ſhorter branch, and furniſhed with a thread and plummet, as repreſented in the plate above referred to.

The uſe of the gunner's quadrant is extremely eaſy; for if the longeſt branch be placed in the mouth of the piece, and it be elevated till the plummet cut the degree neceſſary to hit a propoſed object, the thing is done.

Sometimes on one of the ſurfaces of the long branch, are noted the diviſion of diameters, and weights of iron-bullets, as alſo the bores of pieces.

QUADRANT *of Altitude*, (plate CVII. *fig.* 9.) is an appendage of the artificial globe, conſiſting of a lamina, or ſlip of braſs, the length of a quadrant of one of the great circles of the globe, and graduated. At the end, where the diviſion terminates, is a nut riveted on, and furniſhed with a ſcrew, by means whereof the inſtrument is fitted on to the meridian, and moveable round upon the river, to all points of the horizon, as repreſented in the figure referred to.

Its uſe is to ſerve as a ſcale in meaſuring of altitudes, amplitudes, azimuths, &c. See GLOBE.

QUADRANTAL, in Roman antiquity, a veſſel every way ſquare like a die, ſerving as a meaſure of liquids. Its capacity was eighty libræ or pounds of water, which made forty-eight ſextaries, two urnæ, or eight congii.

QUADRANTAL TRIANGLE, a ſpherical triangle, one of whoſe ſides at leaſt is a quadrant of a circle, and one of its angles a right angle. See TRIANGLE.

QUADRAT, *Quadratum*, a mathematical inſtrument, called alſo a geometrical ſquare, and line of ſhadows: it is frequently an additional member on the face of the common quadrant, as alſo on thoſe of Gunter's and Sutton's quadrant.

QUADRAT, in printing, a piece of metal caſt like the letters, to fill up the void ſpaces between words, &c. There are quadrats of different ſizes, as m quadrats, n quadrats, &c. which are, reſpectively, of the dimenſions of theſe letters.

QUADRATIC *Equation*, in algebra, is that which involves one unknown quantity, and, at the ſame time, involves the ſquare of that quantity and the product of it multiplied by ſome known quantity. — This kind of equations may be reſolved by the following rule:

1. Tranſpoſe all the terms that involve the unknown quantity to one ſide, and the known terms to the other ſide of the equation.

2. If the ſquare of the unknown quantity is multiplied by any coefficient, you are to divide all the terms by that coefficient, that the coefficient of the ſquare of the unknown quantity may be an unit.

3. Add to both ſides the ſquare of half the coefficient prefixed to the unknown quantity itſelf, and the ſide of the equation, that involves the unknown quantity, will then be a complete ſquare.

4. Extract the ſquare root from both ſides of the equation, which you will find, on one ſide, always to be the unknown quantity with half the foreſaid coefficient ſubjoined to it; ſo that by tranſpoſing this half, you may obtain the value of the unknown quantity expreſſed in known terms.

Thus, ſuppoſe $y^2 + 2ay = b$,

Add the ſquare of a to both ſides of the equation, we have $yy + 2ay + aa = b + aa$; extract the root, $y + a = \sqrt{b + a^2}$. Tranſpoſe a, and $y = \sqrt{b + aa} - a$.

Let $y^2 - 2ay = b$, then $y^2 - 2ay + a^2 = b + a^2$, and $y - a = \sqrt{b + a^2}$; hence $y = \sqrt{b + a^2} + a$.

Let $2ay - y^2 = b$, then $y^2 - 2ay = -b$, and by adding the ſquare of a to both ſides, we have $y^2 - 2ay + aa = aa - b$, and $y = a \pm \sqrt{aa - b}$.

The

The ſquare root of any quantity, as $+aa$, may be $+a$ or $-a$, and hence all quadratic equations admit of two ſolutions. In the firſt example, after finding that $y^2+2ay+aa=b+aa$, it may be inferred, that $y+a=\sqrt{b+a^2}$, or to $-\sqrt{b+a^2}$; ſince $-\sqrt{b+a^2}\times+\sqrt{b+a^2}$ gives $b+a^2$, as well as $+\sqrt{b+a^2}\times+\sqrt{b+a^2}$. There are, therefore, two valves of y; the one gives $y=+\sqrt{b+a^2}-a$, the other $y=-\sqrt{b+a^2}-a$.

Since the ſquare of all quantities is poſitive, it is plain, that the ſquare root of a negative quantity is imaginary, and cannot be aſſigned. Therefore there are ſome quadratic equations that cannot have any ſolution. For example:

Suppoſe $y^2-2ay+3a^2=0$.

Then $y^2-2ay=-3a^2$.

Add a^2 to both, $y^2-2ay+a^2=-3a^2+a^2=-2a^2$.

Extract the root $y-a=\pm\sqrt{-2a^2}$, and $y=a\pm\sqrt{-2a^2}$.

Whence the two valves of y muſt be imaginary or impoſſible, becauſe the root of $-2a^2$ cannot poſſibly be aſſigned.

QUADRATING *of a Piece*, among gunners, is the due placing of a piece of ordnance, and poiſing it in its carriage, and having its wheels of an equal height, &c. See GUNNERY.

QUADRATRIX, in geometry, a mechanical line, by means whereof we can find right lines equal to the circumference of circles, or other curves, and their ſeveral parts.

QUADRATRIX *of Dinoſtrates*, ſo called from its inventor Dinoſtrates, is a curve, whereby the quadrature of the circle is effected mechanically.

QUADRATRIX *Tſchirnhauſiana*, is a tranſcendental curve invented by M. Tſchirnhauſen, whereby the quadrature of the circle is likewiſe effected.

QUADRATURE, *Quadratura*, in geometry, the art of ſquaring, or reducing a figure to a ſquare. See CIRCLE, CURVE, FLUXIONS, SERIES, &c.

QUADRATURE, in aſtronomy, that aſpect of the moon when ſhe is 90° diſtant from the ſun; or when ſhe is in a middle point of her orbit, between the points of conjunction and oppoſition, namely, in the firſt and third quarters. See MOON.

QUADRATURE-LINES, are two lines placed on Gunter's ſector: they are marked with Q. and 5, 6, 7, 8, 9, 10: of which Q. ſignifies the ſide of the ſquare, and the other figures the ſides of polygons of 5, 6, 7, &c. ſides. S, on the ſame inſtrument, ſtands for the ſemi-diameter of a circle, and 90 for a line equal to 90° in circumference.

QUADRATUS, in anatomy, a name given to ſeveral muſcles, on account of their ſquare figure.

QUADREL, in building, a kind of artificial ſtone, ſo called from its being perfectly ſquare.

The quadrels are made of a chalky earth, &c. and dried in the ſhade for two years. Theſe were formerly in great requeſt among the Italian architects.

QUADRILATERAL, in geometry, a figure whoſe perimeter conſiſts of four right lines, making four angles; whence it is alſo called a quadrangular figure. The quadrilateral figures are either a parallelogram, trapezium, rectangle, ſquare, rhombus, or rhomboides.

QUADRUPEDS, *quadrupedia*, in zoology, a claſs of land-animals, with hairy bodies, and four limbs or legs proceeding from the trunk of their bodies: add to this, that the females of this claſs are viviparous, or bring forth their young alive, and nouriſh them with milk from their teats.

This claſs, though ſtill numerous enough, will be conſiderably leſſened in number, by throwing out of it the frog, lizard, and other four-footed amphibious animals. See AMPHIBIOUS.

On the other hand, it will be increaſed by the admiſſion of the bat; which, from its having the fore-feet webbed with a membrane, and uſing them as birds do their wings in flying, has erroneouſly been ranked among the bird-kind.

Linnæus ſubdivides the quadruped-claſs into ſix orders, which characterizes from the number, figue,

and diſpoſition of their teeth. The firſt order he calls anthropomorpha, from their reſemblance to the human ſhape: theſe have four fore-teeth in each jaw. The feræ, or beaſts of prey, make the ſecond order, and are diſtinguiſhed by having ſix ſharp-pointed fore-teeth in each jaw, and very long canine teeth. The third order, denominated agriæ, is ſufficiently diſtinguiſhed by having no teeth at all. The glires make the fourth claſs, and are diſtinguiſhed by having the fore-teeth only two in number, and thoſe prominent. The pecora conſtitute the fifth order, and have no fore-teeth at all in the upper jaw, and the fore-teeth in the lower jaw are ſix. The ſixth and laſt order is that of the jumenta, the teeth of which are few in number, and diſpoſed in an irregular manner, quite different from that of the five preceding orders.

QUADRUPLE, a ſum or number multiplied by four, or taken four times.

This word is particularly uſed for a gold coin, worth four times as much as that of which it is the quadruple.

QUÆSTUS, in law, ſignifies whatever a perſon has by purchaſe; as hereditas denotes that which one has by deſcent, or hereditary right.

QUAKERS, a religious ſect which made its firſt appearance in England during the interregnum; ſo called, in deriſion, from certain unuſual tremblings with which they were ſeized at their firſt meetings. Their founder was George Fox, a ſhoemaker, born at Drayton, in Leiceſterſhire; who, as he worked at his trade, uſed to meditate much on the ſcriptures: at length he began to ſee viſions, and ſet up for a preacher. He propoſed but few articles of faith, inſiſting chiefly on moral virtue, mutual charity, the love of God, and a deep attention to the inward motions and ſecret operations of the ſpirit. He required a plain ſimple worſhip, and a religion without ceremonies, making it a principal point to wait in profound ſilence the directions of the Holy Spirit.

Quakers were at firſt guilty of ſome extravagances, but theſe wore off, and they ſettled into a regular body, profeſſing great auſterity of behaviour, a ſingular probity and uprightneſs in their dealings, a great frugality at their tables, and a remarkable plainneſs and ſimplicity in their dreſs.

The ſyſtem of the Quakers is laid down in fifteen theſes, by Robert Barclay, in a ſenſible, well wrote apology, addreſſed to Charles II. Their principal doctrines are, That God has given to all men, without exception, ſupernatural light, which being obeyed can ſave them; and that this light is Chriſt, the true light, which lighteth every man that cometh into the world: that the ſcriptures were indeed given by inſpiration, and are preferable to all the other writings in the world; but that they are no more than ſecondary rules of faith and practice, in ſubordination to the light or ſpirit of God, which is the primary rule: that immediate revelation is not ceaſed, a meaſure of the ſpirit being given to every one: that all ſuperſtitions and ceremonies in religion of mere human inſtitution, ought to be laid aſide: as alſo, in civil ſociety, the ſaluting one another by pulling off the hat, bowing, or the like; and the ſaying *you* inſtead of *thou*, to a ſingle perſon: that men and women ought to be plain and grave in their apparel, ſober and juſt in their whole converſation, and at a word in all their dealings; and not to ſwear, to go to war, to fight in private quarrels, or even to bear any carnal weapons. They alſo entirely ſet aſide the two ſacraments, baptiſm and the Lord's ſupper; admit no clergy among them, but any one, without diſtinction, who is of a ſober life, and believes him or herſelf to be moved thereto by the ſpirit, is allowed to preach in their aſſemblies; and they hold it unlawful to pay tythes, or church-rates. In ſhort, they are a quiet inoffenſive people, of exemplary morals, remarkably charitable and friendly to each other, and have never yet been guilty of perſecution, though they have had it in their power.

As to diſcipline and polity, the affairs of the community are managed in their aſſemblies, of which there are ſeveral kinds; as monthly, quarterly, yearly, ſecond days meetings, and meetings of ſufferings. The monthly and quarterly meetings are held in their reſpective counties, to which deputies are ſent from the ſeveral

particular

particular meetings, and enquiry is made into the ſtate of each meeting; who violate the laws of the community; who pay tythes or church-rates, and who ſuffer for the non-payment of either: here too they excommunicate, and receive again into their communion. Of all which regiſters are kept.

From theſe meetings appeals lie to their yearly aſſemblies, which are always held in London, and conſiſt of three orders or claſſes; repreſentatives ſent from the quarterly meetings, correſpondents from foreign countries and the ſeveral counties, and preachers. Hither are tranſmitted accounts of what has been tranſacted in all the monthly and quarterly meetings: here meaſures are concerted, and directions given as to behaviour about tythes, rates, &c. and here they compoſe differences and make proviſion for the poor: here public acccounts are audited, and inſtructions given to the deputies to be obſerved at their return; and from hence a yearly epiſtle of admonition is diſpatched to be read in all the monthly and quarterly meetings.

The ſecond day's meeting is a ſtanding committee, conſiſting of the principal preachers in and about the city, who meet every Monday to conſider of particular caſes and exigencies which happen between the yearly meeting.

The meetings of ſufferings is held every week, and conſiſts of the correſpondents for each county. Its buſineſs is to receive complaints for ſuch as have ſuffered for non-payment of tythes and church-rates, and to procure them relief, either by ſending them money, for which they have a ſettled fund, or by ſoliciting their cauſe, or both.

QUALITY, *Qualitas*, is defined by Mr. Locke, to be the power in a ſubject of producing any idea in the mind: thus a ſnow-ball having the power to produce in us the ideas of white, cold, and round, theſe powers, as they are in the ſnow ball, he calls qualities; and as they are ſenſations, or perceptions, in our underſtandings, he calls ideas. See IDEA.

Theſe qualities, according to the ſame philoſopher, are of two ſorts; firſt, original or primary qualities, are thoſe inſeparable from body, and ſuch as it keeps in all its changes and ſituations: theſe are ſolidity, extenſion, motion or reſt, number and figure: thus, take a grain of wheat, divide it into two parts, each has ſolidity, extenſion, figure, mobility; divide it again and it ſtill retains the ſame qualities, and will do ſo ſtill, though you divide it on till the parts become inſenſible. Secondly, ſecondary qualities are ſuch, whatever reality we by miſtake may attribute to them, as in truth are nothing in the objects themſelves, but powers to produce various ſenſations in us, and depend on the qualities before-mentioned; ſuch are colours, ſmells, taſtes, ſounds, &c.

The ideas of primary qualities of bodies, are reſemblances of them, and their patterns really exiſt in bodies; but the ideas produced in us by ſecondary qualities have no reſemblance of them at all: and what is ſweet, blue, or warm, in the idea, is but the certain bulk, figure, and motion of the inſenſible parts in the bodies themſelves which we call ſo: thus we ſee that fire at one diſtance produces in us the ſenſation of warmth, which at a nearer approach cauſes the ſenſation of pain. Now what reaſon have we to ſay that the idea of warmth is actually in the fire, but that of pain not in the fire, which the ſame fire produces in us the ſame way. The bulk, number, figure, and motion of the parts are really in it whether we perceive them or no, and therefore may be called real qualities, becauſe they really exiſt in that body; but light and heat are no more really in it than pain or ſickneſs: take away the ſenſation of them, let not the eyes ſee light or colours, nor the ear hear ſounds, let the palate not taſte, or the noſe ſmell, and all colours, taſtes, odours, and ſounds, as they are ſuch particular ideas, vaniſh and ceaſe, and are reduced to their cauſes, that is, bulk, motion, figure, &c. of parts.

Theſe ſecondary qualities are of two ſorts; firſt, immediately perceivable, which by immediately acting on our bodies, produce ſeveral different ideas in us. Secondly, mediately perceivable, which, by operating on other bodies, change their primary qualities ſo as to render them capable of producing ideas in us different from what they did before. Theſe laſt are powers in bodies, which proceed from the particular conſtitutions of thoſe primary and original qualities, to make ſuch a change in the bulk, figure, texture, &c. of another body, as to make it operate on our ſenſes differently from what it did before; as in fire, to make lead fluid: theſe two laſt being nothing but powers relating to other bodies, and reſulting from the different modifications of the original qualities, are yet otherwiſe thought of; the former being eſteemed real qualities, but the latter barely powers. The reaſon of this miſtake ſeems to be this, that our ideas of ſenſible qualities, containing nothing in them of bulk, figure, &c. we cannot think them the effect of thoſe primary qualities, which appear not to our ſenſes to operate in their productions, and with which they have not any apparent congruity; nor can reaſon ſhew how bodies, by their bulk, figure, &c. ſhould produce in the mind the ideas of warm, yellow, &c. but in the other caſe, when bodies operate upon one another, we plainly ſee that the quality produced hath commonly no reſemblance with aught in the thing producing it, and therefore we look upon it as the effect of power: but our ſenſes not being able to diſcover any unlikeneſs between the idea produced in us, and the quality of the object producing it, we imagine that our ideas are reſemblances of ſomething in the objects, and not the effects of certain powers placed in the modification of the primary qualities, with which primary qualities the ideas produced in us have no reſemblance.

Secondary qualities, for the moſt part, ſerve to diſtinguiſh ſubſtances; for our ſenſes fail us in the diſcovery of the bulk, figure, texture, &c. of the minute parts of bodies, on which their real conſtitutions and differences depend: and ſecondary qualities are nothing but powers with relation to our ſenſes. The ideas that make our complex ones, of corporeal ſubſtances, are of three ſorts: firſt, the ideas of primary qualities of things, which are diſcovered by our ſenſes; ſuch are bulk, figure, motion, &c. ſecondly, the ſenſible ſecondary qualities, which are nothing but powers to produce ſeveral ideas in us, by our ſenſes; thirdly, the aptneſs we conſider in any ſubſtance, to cauſe or receive ſuch alterations of primary qualities, as that the ſubſtance, ſo altered, ſhould produce in us different ideas from what it did before: and they are called active or paſſive powers. The mind can have no other idea of ſenſible qualities, than what comes from without, by the ſenſes; nor any other idea of the operations of a thinking ſubſtance, than what it finds in itſelf; and as of two primary qualities of body, viz. ſolid coherent parts, and impulſe, we have clear and diſtinct ideas, ſo likewiſe have we of two primary qualities of ſpirit, viz. thinking and a power of action: and as we have clear and diſtinct ideas of ſeveral qualities inherent in bodies, which are but the various modifications of the extenſion of cohering ſolid parts, and their motion; ſo we have likewiſe the ideas of the ſeveral modes of thinking, viz. believing, doubting, hoping, fearing, &c.

Chemical QUALITIES, thoſe qualities principally introduced by means of chemical experiments, as fumigation, amalgamation, cupellation, volatilization, precipitation, &c.

QUALITY is alſo uſed for a kind of title given to certain perſons, in regard of their territories, ſignories, or other pretenſions.

QUANTITY, *quantitas*, any thing capable of eſtimation, or menſuration; or which, being compared with another thing of the ſame kind, may be ſaid to be greater or leſs than it, equal or unequal to it.

Mathematics is the ſcience or doctrine of quantity, which being made up of parts, is capable of being made greater or leſs. It is increaſed by addition, and diminiſhed by ſubtraction; which are therefore the two primary operations that relate to quantity. Hence it is that any quantity may be ſuppoſed to enter into algebraic computations two different ways, which have contrary effects, viz. either as an increment or as a decrement. See the article ADDITION and SUBTRACTION.

As addition and ſubtraction are oppoſite, or an increment is oppoſite to a decrement; there is an analogous oppoſition between the affections of quantities that are conſidered in the mathematical ſciences; as between ex-

ceſs

ceſs and defect, between the value of effects or money due to a man, and money due by him; a line drawn towards the right, and a line drawn towards the left; gravity, and levity; elevation above the horizon, and depreſſion below it. When two quantities equal in reſpect of magnitude, but of thoſe oppoſite kinds, are joined together, and conceived to take place in the ſame ſubject, they deſtroy each other's effect, and their amount is nothing. A power is ſuſtained by an equal power, acting on the ſame body with a contrary direction, and neither have effect. When two unequal quantities of thoſe oppoſite qualities are joined in the ſame ſubject, the greater prevails by their difference; and when a greater quantity is taken from a leſſer of the ſame kind, the remainder becomes of the oppoſite kind. When two powers or forces are to be added together, their ſum acts upon the body; but when we are to ſubſtract one of them from the other, we conceive that which is to be ſubſtracted, to be a power with an oppoſite direction; and if it be greater than the other, it will prevail by the difference. This change of quality only takes place where the quantity is of ſuch a nature as to admit of ſuch a contrariety or oppoſition. We know nothing analogous to it in quantity abſtractly conſidered, and cannot ſubſtract a greater quantity of matter from a leſſer; or a greater quantity of light from a leſſer; and the application of this doctrine to any art or ſcience, is to be derived from the known principles of the ſcience.

A quantity that is to be added, is called a poſitive quantity; and a quantity to be ſubſtracted, is ſaid to be negative.

Quantities are ſaid to be like or ſimilar, that are of the ſame denomination, or are repreſented by the ſame letter or letters, equally repeated: but quantities of different denominations, or repreſented by a different letter or letters, are ſaid to be unlike or diſſimilar. A quantity conſiſting of more than one term is called a compound quantity; whereas that conſiſting of one term only is denominated a ſimple quantity.

The quantity of matter in any body, is the product of its denſity into its bulk; or a quantity ariſing from the joint conſideration of its magnitude and denſity; as, if a body be twice as denſe, and take up twice as much ſpace as another, it will be four times as great. This quantity of matter is beſt diſcoverable by the abſolute weight of bodies. See GRAVITY.

The quantity of motion in any body is the factum of the velocity into the maſs, or it is a meaſure ariſing from the joint conſideration of the quantity of matter, and the velocity of the motion of the body; the motion of any whole being the ſum or aggregate of the motion in all its ſeveral parts. Hence, in a body twice as great as another, moved with an equal velocity, the quantity of motion is double; if the velocity be double alſo, the quantity of motion will be quadruple. Hence, the quantity of motion is the ſame with what we call the momentum or impetus of a moving body.

Combination of QUANTITIES. See the article COMBINATION.

Commenſurable QUANTITIES. See the article COMMENSURABLE.

Expanential QUANTITY. See the article EXPONENTIAL.

Infinite QUANTITIES. See INFINITE *Quantities* and INFINITESIMALS.

Tranſcendental QUANTITIES. See the article TRANSCENDENTAL.

Variable QUANTITIES. See VARIABLE.

QUANTITY, in grammar, an affection of a ſyllable, whereby its meaſure, or the time wherein it is pronounced, is aſcertained; or that which determines the ſyllable to be long or ſhort.

QUANTITY is alſo the object of proſody, and diſtinguiſhes verſe from proſe; and the œconomy and arrangement of quantities, that is, the diſtribution of long and ſhort ſyllables, makes what we call the number.

The quantities are uſed to be diſtinguiſhed, among grammarians, by the characters ˘, ſhort, as pĕr; and —, long, as rōs. There is alſo a common, variable, or dubious quantity; that is, ſyllables that are one time taken for ſhort ones, and at another time for long ones, as the firſt ſyllable in *Atlas*, *patres*, &c. Feet are made up of quantities. See FOOT.

The quantity of a ſyllable is either natural or accidental: natural quantity is that taken from the nature of the vowel, as *re* in *reſiſto* is ſhort, and *de* in *depello* is long. Accidental quantity is that departing from the natural quantity, merely by accident, as *re* in *reſtiti* is long, becauſe it is immediately followed by two conſonants; and *de* in *deamo* is ſhort, becauſe it immediately precedes a vowel.

The quantity of ſyllables is known two ways. 1. By rules for that purpoſe. And, 2. By authority. The rules for this end are taught by that part of grammar called proſody; the authority made uſe of in this caſe is no more than examples from, or the teſtimony of, approved authors; and is never uſed but either when the rules are deficient, or when we are unacquainted with them. The quantity of the ſyllables is but little fixed in the modern tongues; and there is ſtill leſs regard had to it in the compoſition of modern verſes. The want of feet, or rather the ſhortneſs and uniformity of our feet, makes a world of difference between the numbers of the antient and modern verſe. The antients ſubſiſted by their quantities alone; ſo well were they diſtinguiſhed, and ſuch a harmony did they produce. Our quantities make ſuch poor muſic, that we are generally forced to call in the Gothic aid of rhyme, to diſtinguiſh our verſe from proſe.

QUARANTAIN, QUARENTINE, or QUARANTENA, in old law books, denotes the ſpace of forty days. It alſo ſignifies a benefit allowed to the widow of a man dying ſeiſed of lands, &c. by which ſhe may challenge to continue in his capital meſſuage, or chief manſion-houſe, ſo it be not a caſtle, for the ſpace of forty days after his deceaſe. And if the heir or any other perſon eject her, ſhe may have the writ de quarantena habenda.

QUARANTAIN is more particularly uſed for a term of forty days, which veſſels, coming from places ſuſpected of contagion, are obliged to wait in certain places appointed to air themſelves, before they come into port. See the article LAZAR-HOUSE.

QUARREL, *Querela*, in law, is generally applied to perſonal and mixed actions in which the plaintiff is called querens: and hence it is that if a perſon releaſe all quarrels, it is taken to be as beneficial to the releaſee, as if it were a releaſe of all actions; ſince all actions both real and perſonal are thereby releaſed.

QUARRY, a place under ground, out of which are got marble, free-ſtone, ſlate, lime-ſtone, or other matters proper for buildings.

Quarries of free-ſtone are in many places opened, and the ſtone brought out, in the following manner: they firſt dig a hole in the manner of a well, twelve or fourteen feet in diameter, and the rubbiſh drawn out with a windlaſs in large oſier baſkets, they heap up all around; placing their wheel, which is to draw up their ſtones, upon it. As the hole advances, and their common ladder becomes too ſhort, they apply a particular ladder for the purpoſe. When they have got through the earth, and are arrived at the firſt bank or ſtratum; they begin to apply their wheel and baſkets to diſcharge the ſtones as faſt as they dig through them. In freeing the ſtone from the bed, they proceed thus: as common ſtones, at leaſt the ſofter kinds, have two grains, a cleaving grain, running parallel with the horizon, and a breaking grain, running perpendicular thereto; they obſerve by the grain where it will cleave, and there drive in a number of wedges, till they have cleft it from the reſt of the rock. This done they proceed to break it; in order to which applying the ruler to it, they ſtrike a line, and by this cut a channel with their ſtone-ax; and in the channel if the ſtone be three or four feet long, ſet five or ſix wedges, driving them in very carefully with gentle blows, and ſtill keeping them equally forward. Having thus broken the ſtone in length, which they are able to do of any ſize within half an inch, they apply a ſquare to the ſtraight ſide, ſtrike a line, and proceed to break it in breadth. This way of managing ſtone is found vaſtly preferable to that where they are broken at random: one load of the former being found to do the buſineſs of a load and a half of the latter. But it may be obſerved, that this cleaving

grain being generally wanting in the harder kinds of ſtones, to break up theſe in the quarries, they have great heavy ſtone-axes, with which they work down a deep channel into the ſtone; and into this channel, at the top, lay two iron bars between which they drive their iron wedges.

Some in dividing the ſtone, eſpecially the very hard kinds, make uſe of gunpowder, with very good effect. In order to which, making a ſmall perforation pretty deep in the body of the rock, ſo as to have that thickneſs of rock over it judged proper to be blown up at once, at the further end of the perforation they diſpoſe a convenient quantity of gunpowder, filling up all the reſt with ſtones and rubbiſh, ſtrongly rammed in, except a ſmall place for the train. By this means is the rock blown into ſeveral pieces, moſt of which are not too big to be managed by the workmen.

QUARRY, or QUARREL, among glaziers, a pane or piece of glaſs cut in a diamond form.

Both words are derived from the French *quarré*, a ſquare.

QUART, a meaſure containing the fourth part of ſome other meaſure. See the article MEASURE.

The Engliſh quart is the fourth part of a gallon, or two pints.

QUARTAN, *Quartana*, in medicine, a ſpecies of intermitting fever, wherein the patient has two fits in four days, or two days quite free from a fit.

It uſually begins about four or five in the afternoon, ſometimes ſooner and ſometimes later, with a great laſſitude, ſtretching, a blunt pain in the head, back, loins, and legs; the feet and hands are cold, and the whole body is pale; and the face and nails livid, to which ſhivering and ſhaking ſupervene. The tongue and the lips tremble; the breathing is difficult, with reſtleſſneſs, and toſſing; the pulſe is contracted and hard, and ſometimes unequal; and there is an anxiety about the præcordia. Theſe ſymptoms continue about two or three hours; and in ſome the body is coſtive, whereas in others there is a ſtimulus to ſtool, and to make water; in ſome again, there is a nauſea or vomiting, with ſtools; and ſome advanced in years, have their minds pretty much diſturbed. The heat comes on gradually, not burning but dry; the pulſe becomes equal, quick, and large, but the dull pain in the head remains, with a vertiginous affection; the ſkin becomes only a little moiſt; and in about four or ſix hours, the ſymptoms vaniſh except a dull pain in the bones, joints, and feet. The urine in the fit is ſometimes thin and watery, and ſometimes thick with a ſediment.

From the experiments of Dr. Langriſh it appears, that the blood is more denſe and tenacious in quotidians than in tertians, and in tertians than in quartans. See QUOTIDIAN and TERTIAN.

As to the cure, a vomit ſhould be given after the firſt fit, in the time of intermiſſion: in tender conſtitutions, ipecacuanha may be given alone, or two ounces of vinum ipecacuanhum; but to the more robuſt, a grain or two of emetic tartar may be added, to be taken in warm water about two hours after the paroxyſm. The evacuation ſhould be facilitated by taking large draughts of water-gruel made fat with freſh butter. Then take the following electuary, which will cruſh the diſeaſe in the bud: viz. take of rob of elder, one ounce; of Peruvian bark, five drams; of the powder of common chamomile-flowers, two drams; of the extract of leſſer centaury and powder of clove-julyflowers, each half a dram; and as much ſyrup of lemons as is ſufficient to reduce them to the form of an electuary. The doſe is half a dram, to be taken every two hours after the fit.

If any thing forbids vomiting, the cure muſt be begun with deterſive and aperient ſalts, as vitriolated tartar, ſal ammoniac, purified nitre, and crab's eyes; and if the ague ſtill continue notwithſtanding the repeated uſe of theſe ſalts, then an equal weight of Peruvian bark muſt be added to them, or the above electuary may be given.

When the patient is ſubject to the hypochondriac paſſion, the ſtomach is inflated, and the body coſtive; then neither vomits nor ſalts muſt be ventured upon, but carminative and emollient clyſters.

In obſtinate quartans, Hoffman greatly commends the following medicine: take of Peruvian bark, three drams; of medicinal regulus of antimony, two drams; of mercurius dulcis, which is not to be triturated with the powder, on account of the ſalts, but only mixed with the point of a knife, of the fineſt crocus martis, and of vitriolated nitre, each one dram; and of oil of mint, four drops: make up all theſe into a powder, of which half a dram, or a dram, may be taken, made into the form of a bolus with rob of elder, and ſyrup of clove-july-flowers.

This method is confirmed by Huxham, who ſays the bark frequently proves ineffectual, without the help of proper alexipharmics; as ſnake-root of Virginia, contrayerva, myrrh, camphor, &c. After four or five paroxyſms, warm chalybeates may be added with very great ſucceſs; but when the patient's complexion has a yellow caſt, and he has a tenſe abdomen, and very coſtive habit of body, mercurial, ſaponaceous deobſtruents with rhubarb, aloetics, or ſal diureticus ſhould be premiſed to, or joined with the bark. Hoffman obſerves, that obſtinate quartans in boys are not to be cured but by purging; and therefore, he directs the following form: take of cream of tartar, one dram; of calx of antimony, twelve grains; of ſulphurated diagrydium, ſix grains; make them into a powder, which may be taken in three doſes, the firſt ſix hours before the fit, the ſecond before the next fit, and the third before the third fit. After this, he orders an infuſion of half an ounce of Peruvian bark in eight ounces of fennel-water; adding the bark of eleutherius, ſal diureticus, and ſalt of tartar, of each one dram, together with half an ounce of ſyrup of clove-july-flowers; a ſpoonful of which ſhould be taken every two hours.

To prevent the return of an ague, the bark muſt be repeated every week or ten days, for three ſeveral times, with the ſame intervals. Likewiſe bitters and chalybeates are very ſerviceable, taken either together or ſeparately.

QUARTATION, in metallurgy, a method of purifying gold, by melting three parts of ſilver with one of gold, and then throwing the mixture into aqua-fortis.

Experience has taught us, ſays Cramer, that aqua-fortis diſſolves ſilver mixed with gold quickly enough, when the gold conſtitutes but one, and the ſilver three parts of a mixed maſs of them: and in this caſe, if the ſolution is not too impetuouſly performed, the gold uſually remains in ſuch a proportion, in the ſame figure that the whole maſs had before the ſeparation of the ſilver by this menſtruum; ſo that in this caſe, there is no reaſon to apprehend the gold's being torn into minute particles, and diſſipated in ſome meaſure, though this can hardly be prevented when the ſilver exceeds the three quarter proportion, in regard to the gold in the maſs. The artificers therefore, always make it their ſtudy to obſerve very exactly this proportion of the gold being one fourth part of the mixture; and thence it is that the operation itſelf has been called quartation.

From this operation we may learn how fallacious the examination made with aqua-fortis alone of the gold rubbed on the touchſtone, muſt neceſſarily prove.

QUARTER, *Quadrans*, the fourth part of any thing, the factional expreſſion for which is $\frac{1}{4}$.

QUARTER, in weights, is generally uſed for the fourth part of an hundred weight averdupois, or 28 ℔.

Uſed as the name of a dry meaſure, quarter is the fourth part of a ton in weight, or eight buſhels.

QUARTER, in law, the fourth part of a year; and hence the days on which theſe quarters commence, are, March 25, called Lady-Day; June 24, or Midſummer-day; September 29, or Michaelmas; and December 21, or St. Thomas the Apoſtle's day. On theſe days rents on leaſes, &c. are uſually reſerved to be paid; though December 25, or Chriſtmas-day, is commonly reckoned the laſt quarter-day.

QUARTER, in aſtronomy, the fourth part of the moon's period: thus, from the new moon to the quadrature is the firſt quarter; from this to full moon, the ſecond quarter, &c.

QUARTER, in heraldry, is applied to the parts or members

members of the firſt diviſion of a coat that is quartered, or divided into four quarters.

Franc-QUARTER, in heraldry, is a quarter ſingle or alone; which is to poſſeſs one fourth part of the field.

This makes one of the honourable ordinaries of a coat.

QUARTER *of a Point*, in navigation, is the fourth part of the diſtance between two cardinal points, which is 2° 48'.

QUARTER, the hinder part of a ſhip's ſide, or that part of the ſide which is neareſt the ſtern, commencing nearly from the mizen chains, and terminated by the faſhion-pieces on the edge of the ſtern. See FASHION-PIECE, CHAINS, and MIZEN.

QUARTER alſo implies the middle of a yard-arm, or that part of a yard-arm on each ſide which is about half-way from the maſt to either of the ends or extremes of the yards.

QUARTER-CLOTH, a long piece of canvas painted with trophies, and other ornamental figures of war, and extended along the upper-ſide of a ſhip's quarter.

QUARTER-DECK is the deck that reaches over all the hind-parts of a ſhip, where the principal officers walk, as on a parade. Above the after-part of this deck is placed the poop, which commonly forms the captain's cabbin in a large ſhip of war, when the one below it, his uſual habitation, is occupied by an admiral or commodore.

QUARTER-GALLERY, a ſort of railed balcony projecting over a ſhip's quarter, cloſe to the ſtern.

QUARTER GUNNERS, certain officers under the command of the gunner of a ſhip of war, to keep the artillery, ammunition, &c. in good order.

QUARTER-MASTER, an officer who walks the quarter-deck of a ſhip of war to watch the man at the helm, and obſerve that the ſhip is properly ſteered, to keep the time regularly by watch-glaſſes, to remark what boats come on board, and to aſſiſt at ſtowing and unſtowing the hold.

QUARTER-NETTING, a ſort of net-work extending from the quarter-rail to the gunnel, which is drawn extremely tight.

QUARTER RAIL, a rail extended along the quarters on each ſide, immediately above the gunnel, or upper-part of the ſide.

QUARTER TACKLE is a tackle, or complication of pullies hung from the quarter of the yard, to hoiſt any thing into or out of the ſhip.

QUARTERING WIND, one that blows on the quarter, which is the faireſt direction poſſible.

QUARTERS, the ſtations of the officers and men of a veſſel of war, in the time of engagement; and hence the poſting them to their ſeveral ſtations is called, quartering the crew.

QUARTER, in the military art, is uſed in various ſenſes, as for the place allotted to a body of troops to encamp upon: thus they ſay, The general has extended his quarters a great way, &c. Quarter alſo ſignifies the ſparing mens lives: thus it is ſaid, The enemy aſked quarter; We gave no quarter.

QUARTER *of an Aſſembly*, is the place of rendezvous, where the troops are to meet, and draw up in a body.

Head QUARTERS, is the place where the general of an army has his quarters, which is generally near the center of the army.

QUARTERS *of Refreſhment*, is the place to which the troops that have been much fatigued are ſent to refreſh themſelves during a part of the campaign.

Winter QUARTERS, the places in which the troops are lodged during the winter, or their reſidence in thoſe places.

QUARTER-MASTER, an officer in the army, whoſe buſineſs is to look after the quarters of the ſoldiers; of which there are ſeveral kinds, viz. The quarter-maſter general, whoſe buſineſs is to provide good quarters for the whole army. Quarter-maſter of horſe, he who is to provide quarters for a troop of horſe. Quarter-maſter of foot, he who is to provide quarters for a regiment of foot,

QUARTER, in the manege, as to work from quarter to quarter, is to ride a horſe three times in upon the firſt of the four lines of a ſquare; then changing your hand, to ride him three times upon the ſecond; and ſo to third and fourth; always changing hands and obſerving the ſame order.

QUARTERS, with reſpect to the parts of a horſe, is uſed in various ſenſes: thus the ſhoulders and fore-legs are called the fore-quarters, and the hips and hinder-legs, the hind quarters. The quarters of a horſe's foot, are the ſides of the coffin, comprehending between the toe and the heel; the inner quarters, are thoſe oppoſite to one another, facing from one foot to the other; and theſe are always weaker than the outſide quarters, which lie on the external ſides of the coffin. Falſe quarters are a cleft in the horn of a horſe's hoof, extending from the coronet to the ſhoe. A horſe is ſaid to be quarter-caſt, when for any diſorder in the coffin we are obliged to cut one of the quarters of the hoof.

QUARTER-CHORD, in mining, is ſeven yards and a quarter, which the miner has croſs-ways of his vein, on either ſide, for liberty to lay his earth, ſtones, and rubbiſh on, and to waſh and dreſs up his ore.

QUARTERS, in building, are thoſe ſlight upright pieces of timber placed between the puncheons and poſts, uſed to lath upon.

Theſe are of two ſorts, ſingle and double; the ſingle quarters are ſawn to two inches thick, and four inches broad; the double quarters are ſawn to four inches ſquare. It is a rule in carpentry, that no quarters be placed at a greater diſtance than fourteen inches.

QUARTER-ROUND, in architecture, is a term uſed by the workmen for any projecting moulding in general whoſe contour is a perfect quadrant of a circle, or which approaches near that figure.

QUARTER-SESSIONS, a general court held quarterly by the juſtices of peace of each county. See JUSTICES *of Peace*.

QUARTER-WHEELING, or QUARTER *of Converſion*, in the military art, is the motion by which the front of a body of men is turned round to where the flank was, by taking a quarter of a circle. If it be done to the right, the man in the right-hand angle keeps his ground and faces about, while the reſt wheel; if to the left, the left-hand man keeps his place.

QUARTERING, in gunnery, is when a piece of ordnance is ſo traverſed that it will ſhoot on the ſame line, or on the ſame point of the compaſs as the ſhip's quarter bears.

QUARTERING, in heraldry, is dividing a coat into four or more quarters, or quarterings, by parting, couping, &c. that is, by perpendicular and horizontal lines, &c.

Counter QUARTERING *a coat*, is when the quarters are ſubdivided each into four.

There are counter-quartered coats that have twenty or twenty-five quarters.

QUARTERLY, in heraldry. A perſon is ſaid to bear quarterly, when he bears arms quartered.

QUARTERN, a diminutive of quart, ſignifying a quarter of a pint.

QUARTO, or 4to, a book of which four leaves, or eight pages, make a ſheet.

QUARTO-DECIMANS, *Quarto-Decimani*, an antient chriſtian ſect, ſo called from their maintaining that the feſtival of Eaſter ought to be celebrated conformably to the cuſtom of the Jews, on the fourteenth day of the moon in the month of March, whatever day of the month that happened to be.

QUASHING, in law, the overthrowing and annulling of any thing.

QUAVER, in muſic, a meaſure of time equal to half a crotchet, or an eighth of a ſemibreve.

The quaver is divided into two ſemi-quavers, and four demi-ſemi-quavers.

QUAVERING, in muſic, trilling or ſhaking; or the running a diviſion with the voice.

QUAY, or KAY. See the article WHARF.

QUEEN, *Regina*, denotes either a woman who holds the crown of a realm, ſingly and by right of blood called

queen

queen regnant; or it is a title, by way of courteſy, given to her that is married to the king, and called queen conſort; or the widow of a king is called queen, but with the addition of dowager. In the firſt ſenſe, queen is the ſame with king, and has the ſame power and prerogative.

QUEEN-BEE, a name given by late writers to what uſed to be called the king-bee, or king of the bees; a large and long-bodied bee, of which kind there is only one found in every ſwarm, and which is always treated with the greateſt reſpect by the reſt. See the article BEE.

QUEEN *Gold*, *Aurum Reginæ*, a royal revenue, belonging to the queen of England, during her marriage to the king, and payable, upon ſeveral grants of the king, by way of oblation, out of fines, amounting to one full tenth part above the entire fine, or ten pounds for every hundred pounds fine, on pardons, contracts, or agreements.

QUE ESTATE, in law, a plea whereby a man intitling himſelf to land, &c. ſaith that the ſame eſtate which another had, he now has from him.

QUE EST MEME, in law, is uſed in actions of treſpaſs, &c. for a direct juſtification of the very act complained of by the plaintiff as a wrong.

QUERELA, QUARREL. See the article QUARREL.

QUESTION, QUESTIO, in logic, &c. a propoſition whoſe truth a perſon being inquiſitive about, propoſes it by way of interrogation to another.

QUEST, or INQUEST, an inquiſition made upon oath of an inpannelled jury.

QUEST MEN, perſons choſen yearly in each ward in London, &c. to enquire into abuſes, eſpecially ſuch as relate to weights and meaſures.

QUESTOR, *Quæſtor*, an officer in ancient Rome who had the care of the public treaſure.

The queſtor's office, queſtorſhip, *quæſtura*, was originally confined to the army. They paid the ſoldiery, took charge of monies accruing by ſpoil, plunder, &c. At length new ones were erected to reſide in the city, and receive the public money, &c.

There were alſo another kind of queſtors whoſe office was to enquire into, and take cognizance of, capital crimes.

QUESTOR *Sacri Palatii*, or Queſtor of the ſacred palace, was one of the firſt dignities under the emperors of Conſtantinople. He ſubſcribed the receipts, and the anſwers to petitions preſented to the emperor: he drew up and ſigned the laws, and took care of the adminiſtration of juſtice.

QUEUE, in heraldry, denotes the tail of the beaſt. If a lion have a forked tail, he is blazoned double queued.

QUEUE *d'aronde*, in fortification, denotes any outworks which are narrower at the gorge than the face or front.

Of this kind there are ſome ſingle as well as double tenailles, and ſome horn-works, whoſe ſides are not parallel.

On the contrary, when the ſides are leſs than the gorge, the work is called *contre queue d'aronde*.

QUICKSILVER, a very ponderous fluid mineral, the ſame as mercury. See the article MERCURY.

QUICK, or QUICKSET-HEDGE, among gardeners, denotes all live hedges, of whatever ſort of plants they are compoſed, to diſtinguiſh them from dead hedges; but, in a more ſtrict ſenſe of this word, it is applied to the hawthorn, or meſpilus ſylveſtris: under which name the young plants, or ſets, are commonly ſold by the nurſery gardeners, who raiſe them for ſale.

In the choice of theſe ſets, thoſe which are raiſed in the nurſery are to be preferred to ſuch as are drawn out of the woods: becauſe the latter have ſeldom good roots; though, as they are larger plants than are commonly to be had in the nurſery, many people prefer them on that account: but from long experience I have found, that thoſe hedges which have been planted with young plants from the nurſery, have always made the beſt hedges. Indeed, if perſons would have patience to wait for theſe from ſeed, and to ſow the haws in the place where the hedge is deſigned, theſe unremoved plants will make a much ſtronger and more durable fence, that thoſe which are tranſplanted: but I am aware that moſt people will be for condemning this practice, as being tedious in raiſing; but, if the haws are buried one year in the ground, to prepare them for vegetation, before they are ſown, it will not be ſo long before this will become a good fence, as is generally imagined. Nay, from ſome trials of this kind, which I have made, I have found, that thoſe plants which have remained where they came up from ſeed, have made ſuch progreſs as to overtake, in ſix years, plants of two years growth, which were tranſplanted at the time when theſe ſeeds were ſown.

And, if the hedges are raiſed from ſeed, it will not be amiſs to mix holly berries with the haws, and, if ſo, theſe berries ſhould alſo be buried one year, to prepare them, ſo that then both will come up together the following ſpring; and this mixture of holly with the quick will not only have a beautiful appearance in the winter, but will alſo thicken the hedge at the bottom, and make it a better fence.

But, where the hedge is to be planted, the ſets ſhould not be more than three years old from the haws; for, when they are older, their roots will be hard and woody; and, as theſe are commonly trimmed off before the ſets are planted, ſo they very often miſcarry; and ſuch of them as do live, will not make ſo good progreſs as younger plants, nor are they ſo durable; for theſe plants will not bear tranſplanting ſo well as many others, eſpecially when they have ſtood long in the ſeed-bed unremoved. *Miller's Gard. Dict.*

QUID, WHAT, in the ſchools, denotes a definition: ſo called, as anſwering to the queſtion *Quid eſt?* what is it?

Hence we have two kinds, as nominal, *quid nominis*, and real, *quid rei*.

QUIDDITY, *quidditas*, in the ſchools, the eſſence or nature of a thing known or expreſſed in any definition.

And hence, whatever is eſſential to a thing, is ſaid to be quiddative.

QUIESCENT denotes any thing at reſt, in contradiſtinction to motion.

QUIETISM, the ſentiments of the Quietiſts, a religious ſect which made a great noiſe towards the cloſe of the laſt century.

Molinos, a Spaniſh prieſt, who died at Rome in the priſon of the inquiſition, paſſes for the author of Quietiſm; and yet the Illuminati in Spain had taught ſomething like it before.

The name is taken from a ſort of abſolute reſt, and inaction, which the ſoul is ſuppoſed to be in, when arrived at the ſtate of perfection, which in their language is called the unitive lief.—To arrive at this, a man is firſt to paſs through the purgative way; that is, through a courſe of obedience, inſpired by the fear of hell: hence, he is to proceed into the illuminative way, before he arrive at perfection; to go through cruel combats, and violent pains, i. e. not only the uſual drineſſes of the ſoul, and the common privations of grace, but infernal pains: he believes himſelf damned; and the perſuaſion that he is ſo, continues upon him very ſtrongly ſeveral years: St. Francis des Sailes, ſay the Quietiſts, was ſo fully convinced thereof, that he would not allow any body to contradict him therein. — But the man is, at length, ſufficiently paid for all this, by the embraces of God, and his own deification.

Theſe ſentiments of the Quietiſts, with regard to God, are wonderfully pure and diſintereſted.—They love him for himſelf, on account of his own perfections, independently of any rewards or puniſhments: the ſoul acquieſces in the will of God, even at the time when he precipitates it into hell; inſomuch that, inſtead of ſtopping him on this occaſion, B. Angelo de Foligny cried out, 'Haſte, Lord, to caſt me into hell: do not delay, if thou haſt abandoned me, but finiſh my deſtruction, and plunge me into the abyſs.'

At length, the ſoul, after long travail, enters into reſt, into a perfect quietude.—Here it is wholly employed in contemplating its God; it acts no more, thinks no more, deſires no more; but lies perfectly open, and at large, to receive the grace of God, who by means thereof drives it where it will, and as he will.

In this ſtate, it no longer needs prayers or hymns, or vows; prayers where the ſpirit labours, and the mouth opens, are the lot of the weak and the imperfect: the ſoul of the ſaint is, as it were, laid in the boſom, and between the arms of its God, where, without making any motion, or exerting any action, it waits, and receives the divine graces. — It, then, becomes happy: quitting the exiſtence it before had, it is now changed, it is transformed, and, as it were, ſunk and ſwallowed up in the Divine Being, inſomuch as not to know or perceive its being diſtinguiſhed from God himſelf. *Fenel. Max. des Saints.*

QUILLS, the large feathers taken out of the end of the wing of a gooſe, crow, &c.

Quills are denominated from the order in which they are fixed in the wing, the ſecond and third quills being the beſt for writing, as they have the largeſt and roundeſt barrels. Crow-quills are chiefly uſed for drawing. In order to harden a quill that is ſoft, thruſt the barrel into hot aſhes, ſtirring it till it is ſoft, then taking it out, preſs it almoſt flat upon your knee with the back of a pen-knife, and afterwards reduce it to a roundneſs with your fingers. If you have a number to harden, ſet water and alum over the fire, and while it is boiling put in a handful of quills, the barrels only, for a minute, and then lay them by.

QUILT, a covering for a bed, formed of two pieces of ſilk, cotton, &c. quilted together.

QUILTING, a method of ſewing two pieces of ſilk, linnen, or ſtuff on each other, with wool or cotton between them; by working them all over in the form of chequer or diamond-work, or in flowers. The ſame name is alſo given to the ſtuff ſo worked.

QUILTING, amongſt ſailors, the act of weaving a ſort of coat or matting round a jar or jug to prevent it from breaking.

QUINCUNX, QUINQUE UNCIÆ, denotes five twelfth parts of any thing.

QUNCUNX, in gardening, a diſpoſition of trees originally formed into a ſquare, conſiſting of five trees, one at each corner, and a fifth in the middle; which diſpoſition, repeated again and again, forms a regular grove, and then viewed by an angle of the ſquare or parallelogram preſents equal and parallel alleys.

Or the quincunx is the diſpoſition of trees in ſeveral rows, both length and breadthwiſe; ſo that the firſt tree of the ſecond row commences in the center of the ſquare formed by the two firſt trees of the firſt row, and the two firſt of the third, reſembling the figure of a five in cards.

The modern quincunxes, Daviler obſerves, are made like thoſe of the ancients, except for the fifth tree, which is now generally diſuſed; ſo that being netted, and their alleys viewed by the ſide of the rectangle, they form a perfect chequer.

QUINCUNX, in aſtronomy, &c. denotes an aſpect of the planets, when diſtant from each other one hundred and fifty degrees, or five ſigns.

QUINDECAGON, or rather pentedecagon, in geometry, a plain figure which has fifteen ſides, and as many angles.

The word is compounded of the Latin *quindecim*, fifteen, and the Greek γωνια, angle.

If the ſides be all equal, it is a regular quindecagon. The ſide of ſuch a quindecagon inſcribed in a circle, by Eucl. prop. 16. l. 3. is equal in power to the half difference between the ſide of the equilateral triangle and the ſide of the pentagon, as alſo to the difference of the perpendiculars let fall on both ſides taken together.

QUINQUAGENARIUS, among the Romans, was an officer in the army who had the command of a company of fifty men.

There was alſo an officer of policy ſo called, who had the inſpection of fifty houſes or families.

QUINQUAGESIMA SUNDAY, Shrove-Sunday; ſo called, as being about the fiftieth day before Eaſter.

QUINQUINA, in pharmacy, the name of a very uſeful medicine called alſo Peruvian bark; it being the bark of a tree growing in Peru.

The tree producing this bark is of a middling ſize, called by the Spaniards, from its efficacy againſt intermitting fevers, *palo de calenturas*, or the fever tree. This virtue of the bark is ſaid to have been diſcovered by the Indians about the year 1500, but not revealed to their European maſters till 140 years after; when a ſignal cure having been performed by it on the Spaniſh viceroy's lady, the counteſs del Cinchon, it came into general uſe in thoſe parts, and was diſtinguiſhed by the appellations *pulvis comitiſſæ*, *cortex china china* or *chinchina*, *kina kina* or *kinkina*, and *quina quina*, or *quinquina*. In 1649 a Jeſuit brought a large quantity of it into Italy, which was diſtributed by the fathers of that order, at a great price, in different parts of Europe: about the ſame time a quantity was purchaſed by cardinal de Lugo for the uſe of the poor at Rome. From theſe it received the names of *cortex* or *pulvis Jeſuiticus*, *pulvis patrum*, and *pulvis cardinalis de Lugo*.

This bark is brought to us in pieces of different ſizes, ſome rolled up into ſhort thick quills, and others flat: the outſide is browniſh, and generally covered in part with a whitiſh moſs: the inſide is of a yellowiſh, reddiſh, or ruſty iron colour. The beſt ſort breaks cloſe and ſmooth, and proves friable betwixt the teeth: the inferior kinds appear when broken of a woody texture, and in chewing ſeparate into fibres. The former pulverizes more eaſily than the latter, and looks, when powdered, of a light browniſh colour, reſembling that of cinnamon, but ſomewhat paler.

A bark was ſome time ago brought from America under the name of the female Peruvian bark. This was found, from experience, to be leſs effectual as a medicine than the genuine ſort, which it was frequently ſubſtituted to or mixed with in France, inſomuch that its importation, as the editor of Geoffroy informs us, was prohibited by law. It is conſiderably thicker, whiter on the out ſide, redder within, and weaker in ſmell and taſte than the true bark.

Peruvian bark has a ſlight ſmell, approaching as it were to muſtineſs, yet ſo much of the aromatic kind as not to be diſagreeable. Its taſte is conſiderably bitter, aſtringent, very durable in the mouth, and accompanied with ſome degree of aromatic warmth, but not ſufficient to prevent its being ungrateful.

The febrifuge virtue, for which alone this medicine was at firſt recommended, has now been eſtabliſhed by the daily experience of about a century: and that, when judiciouſly and ſeaſonably adminiſtered, it proves as ſafe as it is effectual, is now alſo beyond diſpute. An emetic, which is in moſt caſes neceſſary, being taken towards the approach of a paroxyſm, that its operation may be over before the fit comes on; the bark is begun at the end of the paroxyſm, or even in the time of the hot fit, and repeated, in doſes of half a dram or more, every third or fourth hour, during the intermiſſion: after the fever has been removed, the medicine is continued for a time, but more ſparingly, to prevent a return. During the uſe of the bark, the pulſe, which betwixt the paroxyſms is generally weak and ſlow, becomes ſtronger and quicker, the appetite mends, the patient grows more chearful, and perſpiration increaſes: theſe may be looked upon as ſure preſages of its ſucceſs. At firſt it frequently occaſions a looſeneſs, and this alſo is ſalutary; but if the purging runs on too long, as the fever rarely yields while this evacuation continues, it is uſually checked by the addition of a little opium: if too great coſtiveneſs enſues, recourſe is had to clyſters. In groſs impure habits, gentle purgatives are premiſed to the bark, or given for a time in conjunction with it: in agues of the inflammatory kind, or accompanied with a great heat, a little nitre is joined or interpoſed: in lax ſpongy conſtitutions, and a thin watery ſtate of the blood, the bark is aſſiſted by bitters, ſnakeroot, camphor, and chalybeates: — where obſtructions of the abdominal viſcera are apprehended, it is not ventured on without the addition of fixed alcaline ſalts, ſal ammoniac, or other aperients. In all caſes, moderate exerciſe, and the drinking of warm liquids, promote its effects.

In remitting fevers, this medicine is leſs ſucceſsful than in thoſe which have perfect intermiſſions: in hectics, or wherever pus is formed, or juices extravaſated, it does harm. In the decline of long nervous fevers, or after a remiſſion, and in thoſe of the low malig-

nant kind, where the blood is colliquated and the ſtrength exhauſted, it proves an excellent cordial, corroborant, and antiſeptic.

Peruvian bark has likewiſe been found ſerviceable in gangrenes and mortifications, and in foul obſtinate ulcers and running ſores of other kinds; in theſe caſes, taken in large and repeated doſes, it frequently brings on a laudable ſuppuration, which degenerates on diſcontinuing the uſe of the medicine, and again turns kindly upon reſuming it. The like effects have been obſerved from it in variolous caſes, where either the puſtules did not duly ſuppurate, or petechiæ ſhewed a diſpoſition to a gangrene: by the uſe of the bark, the empty veſicles filled with matter, watery ſanies changed into thick white pus, and the petechiæ became gradually paler, and at length diſappeared. The principal ſymptom in this diſeaſe that contraindicates this valuably ſuppurant and antiſeptic, is great obſtruction at the breaſt or difficulty of breathing; which are always by this medicine increaſed, inſomuch that ſmall doſes have in ſome caſes endangered ſuffocation.

In tumours of the glands, the Peruvian bark appears to promote not ſuppuration, but reſolution. In the Medical Obſervations and Inquiries publiſhed by a ſociety of phyſicians in London, there are ſeveral inſtances of its being given with ſucceſs in ſcrophulous complaints. Dr. Fothergill obſerves, that inveterate ophthalmiæ generally yield to it: that beginning glandular tumours are very frequently reſolved, and their farther progreſs ſtopt by it: that ſwelled lips, cutaneous blotches ariſing from a like cauſe, are healed, and the tendency to a ſtrumous habit corrected: that it does not ſucceed in all caſes, but there are few in which a trial can be attended with much detriment: that he has never known it to avail where the bones were affected, or where the ſcrophulous tumour was ſo ſituated as to be attended with much pain, as in the joints, or under the membranous covers of the muſcles; for when it attacks theſe parts, the perioſteum, and conſequently the bone, ſeldom eſcape being injured; that here the bark, inſtead of leſſening, adds to the fever which accompanies theſe circumſtances, and if it does not increaſe the force of the miſchief, ſeems at leaſt to haſten its progreſs.

Peruvian bark has been applied likewiſe, in conjunction with other appropriated medicines, and often with good ſucceſs, to the cure of periodic head-achs, hyſterical, hypochondriacal, vertiginous and epileptic complaints, and other diſorders that have regular intermiſſions. By its bitterneſs, aſtringency, and mild aromatic warmth, it ſtrengthens the whole ſyſtem, and proves a medicine of great utility in weakneſs of the ſtomach, uterine fluxes, and ſundry chronical diſeaſes proceeding from a laxity and debility of the fibres. To ſtrengthen the ſolids appears indeed, in all caſes, to be its primary operation; and its ſalutary virtues in different diſeaſes, to be no other than conſequential effects of this general power. In all the diſtempers where bark is known to take place, other aſtringent and bitter medicines, ſingly or combined, have likewiſe been of ſervice, though not equally with this natural combination of them.

The virtues of this bark are very difficultly extracted by long coction in water, and part of what the liquor is by heat enabled to take up begins to ſeparate as ſoon as it is cold. This reſinous part, which is rather melted out by the boiling heat than diſſolved by the water as a menſtruum, ſeems to contain chiefly the aſtringency of the drug; the bitter matter appears to be perfectly diſſoluble, though more difficult to be got completely out.

On boiling a pound of powdered bark for an hour or two in five or ſix quarts of water, the decoction whilſt hot looks clear and reddiſh, but in cooling becomes turbid, and of a pale yellowiſh or wheyiſh hue: in this ſtate it is found to partake, in a great degree, both of the bitterneſs and aſtringency of the bark; but in proportion as it depoſites the matter that made it turbid, it loſes more and more of its ſtypticity, the bitterneſs ſeeming to continue undiminiſhed. The remaining bark, boiled in freſh water, exhibits the ſame appearances for two or three times ſucceſſively; and when, at length, it ceaſes to render the water turbid, it imparts a bitterneſs without aſtringency, retaining ſtill ſome ſhare of bitterneſs itſelf. The vapour which exhales in the firſt coction, being caught in proper veſſels, condenſes into a limpid liquor which ſmells ſtrongly of the bark; though no ſeparable oil is obtained on ſubmitting many pounds to the operation. The ſeveral decoctions, ſtrained and inſpiſſated together, yield an extract, rather leſs bitter, and much leſs ſtyptic, than the bark in ſubſtance: this extract is kept in the ſhops in a ſoft and a hard form; the one of a proper conſiſtence for making into pills, the other fit for being reduced into powder.

As decoctions of bark loſe of their virtue in being made fine by ſettling and colature, they are generally directed to be taken turbid; only the groſſer parts of the powder being ſeparated by paſſing them through a ſieve. This form does not appear to be ſuperior, in elegance, any more than in efficacy, to draughts with the bark in ſubſtance: a mixture of a fine powder with infuſion of liquorice and a little of any grateful aromatic water, is far more palatable than the turbid decoction. Among all the materials I have tried for covering the taſte of the bark, liquorice, or its extract, were found to anſwer the purpoſe moſt effectually, whether in a liquid form or in that of an electuary.

As this drug gives out its virtue ſo difficultly and imperfectly to boiling water, it has not been ſuſpected that cold water would have any conſiderable action on it: I have nevertheleſs found, that an infuſion in cold water is rather ſtronger in taſte than even the turbid decoction, though the latter has ſomewhat more of a kind of fulneſs in the mouth. It is by means of a gummy matter in vegetables, that the reſinous parts become diſſoluble in watery liquors; and it ſeems probable that, in boiling, part of the gummy principle of the bark is haſtily diſſolved and diſunited from the reſinous, whereas cold water, acting more gradually, extracts them both together. The cold infuſions ſtrike a black colour with chalybeate ſolutions; which I have not obſerved any of the decoctions to do, at leaſt in any conſiderable degree, whether turbid or tranſparent; a proof that the former contain the aſtringent matter of the bark in a perfectly diſſolved ſtate, and the latter not. I have given the infuſions in intermitting fevers as well as other diſorders, with all the ſucceſs that could have been expected from any preparation of this valuable medicine: the proportions commonly followed were, one ounce of the powdered bark and eight or twelve of water, which were macerated without heat for twenty-four hours, and the clear liquor given in doſes of two or three ounces.

It is a common opinion, that bark in ſubſtance is more effectual than any preparation of it. Thus much is plain, that the infuſions, as well as the decoctions, have not near ſo much effect as the quantity of bark they were made from, as the menſtruum does not in either caſe completely extract its active matter: but their effects are evidently the ſame in kind, and the difference in degree may be compenſated by an increaſe in the quantity.

The turbid decoctions, on the addition of any of the concentrated mineral acids, in the proportion of one drop to about a quarter of an ounce, become tranſparent, of a bright pale yellow colour, and of a rougher or more acerb taſte, but with the loſs of their bitterneſs: the vegetable acids, added in a proportionably larger quantity, render them likewiſe tranſparent, and improve their roughneſs, without much diminiſhing their bitterneſs: all theſe mixtures depoſite, on ſtanding, a little powdery ſediment. Alcalies, both fixed and volatile, occaſion a more copious precipitation, and inſtead of making the turbid decoctions clear, make the clear turbid.

Rectified ſpirit receives from bark a deep reddiſh brown colour, and takes up much more of its active matter than watery liquors: by digeſting the powder firſt in ſome rectified ſpirit, and then boiling it in water, nearly the whole of its virtue is pretty readily got out. In inſpiſſating the filtered tincture, the ſpirit carries off nothing remarkable of its ſmell or taſte: the remaining extract retains the peculiar flavour of the bark, as well as its aſtringency and bitterneſs, and proves a very elegant preparation from the tincture by water, as having the reſinous part ſomewhat divided by an admixture of the gummy. The ſpirituous tincture, and the decoction of the reſiduum, may be united into an extract, poſſeſſing this advantage

vantage in a greater degree, by inſpiſſating them ſeparately to the conſiſtence of a ſyrup, then mixing them together, and continuing the evaporation with a gentle heat.

Proof ſpirit extracts leſs from bark than rectified ſpirit, but more than water. Four ounces of the powder, macerated for ſome hours without heat, in a quart of proof ſpirit, impart a conſiderable degree both of bitterneſs and aſtringency: on applying heat, the taſte becomes ſtronger, the colour darker, and the liquor ſomewhat turbid; from whence it may be concluded, that the reſinous part is not by this menſtruum completely diſſolved.

Spirit of ſal ammoniac made with fixed alcaline ſalt, by maceration with powdered bark in the above proportion, receives from it very little taſte or colour. The ſpirit prepared with quicklime, and the dulcified ſpirit, extract in a few hours a very deep colour, and become ſtrongly impregnated with its virtue. Though the ſpirit made with quicklime is held too acrimonious to be given internally by itſelf, it is not liable to that objection here; its pungency being ſheathed by the ſubſtance which it diſſolves. *Lewis's Materia Medica.*

QUINTAL, in commerce, a hundred pounds weight.

The quintal admits of ſome difference in different places, according as the pound conſiſts of more or fewer ounces.

The Engliſh quintal uſually conſiſts of one hundred and twelve pounds avoirdupoiſe, and is divided into four quarters.

QUINTESSENCE, QUINTA ESSENTIA, in chemiſtry, a preparation conſiſting of the eſſential oil of ſome vegetable ſubſtance, incorporated with ſpirit of wine.

Of this there are two kinds, namely, liquid and dry: the former is produced by putting any diſtilled aromatic or eſſential oil into a clean dry glaſs, and pouring to it twelve times its quantity of pure alcohol diſtilled from alcali, ſo as not to contain the leaſt water: ſhake them together, and the oil will intirely mix with the alcohol, ſo as to form one ſimple tranſparent liquor.

Dry quinteſſences are got by pouring alcohol, wherein an aromatic oil is diſſolved, upon ten times its weight of dry loaf ſugar, reduced to a fine powder. Grind them exactly together in a glaſs body, kept on all ſides moderately warm, that the remaining ſpirit may gently exhale, and, by means of a ſtill-head, be collected in the form of a liquid quinteſſence; and thus the ſugar will remain dry, yet impregnated with the quinteſſence. Let this now be put immediately into a glaſs veſſel cloſe ſtopped, and preſerved for uſe.

QUINTILE, QUINTILIS, in aſtronomy, an aſpect of the planets, when they are 72 deg. diſtant from one another, or a fifth part of the zodiac.

QUINTILIANS, a ſect of ancient heretics, thus called from their propheteſs Quintilia. In this ſect the women were admitted to perform the ſacerdotal and epiſcopal functions. They attributed extraordinary gifts to Eve for having firſt eaten of the tree of knowledge; told great things of Mary the ſiſter of Moſes, as having been a propheteſs, &c. They added, that Philip the deacon had four daughters, who were all propheteſſes, and were of their ſect. In theſe aſſemblies it was uſual to ſee the virgins entering in white robes, perſonating propheteſſes.

QUINZY, QUINSEY, or ANGINA, in medicine, a pain and inflammation of the fauces, a ſwelling of the uvula, tonſils, and larynx, which being accompanied with a fever, occaſions a difficulty of reſpiration and deglutition. This diſeaſe generally prevails about the latter end of ſpring or beginning of ſummer. When the ſwelling, pain, and redneſs, appear moſtly on the out-ſides, it is, according to Hoffman, the prognoſtic of a happy ſolution of the diſeaſe: but when the external ſwelling ſuddenly diſappears, without a mitigation of the ſymptoms, it ſhews the morbific matter to be tranſlated elſewhere, and that the diſeaſe will change to a frenzy, or peripneumony. This diſeaſe may alſo terminate in a ſuppuration, gangrene, or ſchirrhus. A frothing at the mouth, the tongue vaſtly ſwelled, and of a purple, blackiſh colour, portend death.

The quinzy is generally diſtinguiſhed by modern writers into the idiopathic and ſymptomatic. The firſt, where it is itſelf the diſeaſe, and owes its origin only to a plethora; the ſecond, where it is but the accidental ſymptom of an inflammatory fever, or ſome other diſeaſe, about the time of its criſis.

Dr. Mead diſtinguiſhes the quinzy into three ſorts; the firſt of which he calls the watery quinzy; the ſecond, a gangrene of the tonſils; and the third, a ſtrangulation of the fauces. In the firſt ſort, the glands of the mouth, palate, and neighbouring parts are ſwoln. In the ſecond, an inflammation without a perfect ſuppuration ſeizes the tonſils, which ſwell and grow hard; a gangrene ſoon enſues, which, if not ſpeedily relieved, proves fatal.

In the third ſort, all the nerves are convulſed, and the patient drops down dead ſuddenly: however, this ſpecies of quinzy, though deſcribed by Hippocrates, is yet very rare. If it can be foreſeen, it ought to be prevented by evacuations of all kinds; that is, bleeding, purging, bliſtering, iſſues, and diuretics; and it will be of ſervice to practiſe abſtinence, or a moderation in eating and drinking. In the watery quinzy, which ſometimes rages like an epidemic fever, eſpecially in places near the ſea, bleeding plentifully as ſoon as poſſible is recommended; afterwards clyſters, gentle purges, bliſters under the chin, and on the ſides of the neck; and if this courſe does not ſucceed, the palate muſt be pretty deeply ſcarified about the tongue and ſublingual veins.

In theſe inflammations in general, a ſlight diarrhœa relieves the patient, according to Arbuthnot. Therefore aliments which promote it are of ſervice; ſuch are tamarinds infuſed in whey, decoctions of farinaceous vegetables moderately acidulated, and ſuch as abound with a cooling nitrous ſalt are uſeful. Burnet is ſaid to be a ſpecific in the quinzy; mulberries, and all acids are beneficial. The mouth and throat muſt be kept moiſt, and the noſe clear, that the air may have a free paſſage through it. Sydenham orders to bleed plentifully in the arm, and Boerhaave directs it to be by a large orifice. Afterwards a ſublingual vein ſhould be opened; but, according to Hoffman, bleeding in the jugular yields the beſt aſſiſtance. If the ſymptoms continue to be very urgent, the bleeding may be repeated in ſix or eight hours time, till they begin to be more mild. After the firſt bleeding, Sydenham orders a ſtrong and large bliſter to be laid to the neck: then let the parts inflamed be touched with the following mixture. Take honey of roſes, as much as you pleaſe; and mix it with as much ſpirit of ſulphur as is ſufficient to give it the greateſt ſharpneſs. Afterwards the following gargle is to be held in the mouth till it is hot; and is to be repeated pretty often: take plantain water, and frog-ſpawn, of each four ounces; red roſes, four ounces; the whites of three eggs beat in water; and two drams of cryſtal ſugar.

When the fauces are dry, hot, and the tongue ſwells; with difficulty of breathing and ſwallowing, Hoffman orders to take of the whites of eggs beat in water, two ounces; water of roſes, one ounce; ſal prunella, twelve grains; ſyrup of quinces, one ounce. Make a linctus, which is to be taken often; and let the neck be anointed as well behind as before with the following camphorated oil. Take of the oil of ſweet almonds, one ounce; oil of white poppies, one dram; camphor, half a dram; after which let the patient take a cooling emulſion.

Boerhaave, after bleeding, orders a ſtrong purge, and if that cannot be taken, a ſtrong clyſter. Emollient ſteams, or even the ſteam of hot water taken in at the mouth, is beneficial. If the patient is not able to ſwallow any nouriſhment, take of good broths of fleſh-meat, ten ounces; nitre, ten grains; ſpirit of ſalt, ſix drops; make a clyſter to be ejected every eight hours, and retained as long as is poſſible. Hoffman ſays, that if the tumour tends to a ſuppuration, it is beſt promoted by holding dried figs in the mouth, and that when the tonſils are full of an inflammatory ichor, honey of roſes, mixt with ſpirit of vitriol, and often applied to the part with a pencil, is excellent. In a latent internal exceeding hot quinzy, the mouth muſt be frequently moiſtened with milk or cream, with an addition of ſal prunella and ſyrup of poppies.

Dr. Pringle obſerves, that the inflammatory quinzy is moſt frequent, as well as dangerous among ſoldiers, upon their firſt encampment; and that its tendency to bring on a ſuffocation, indicates the neceſſity of ſpeedy and large bleedings, purging, and bliſtering. He alſo recommends the following application, as one of the moſt efficacious remedies in this terrible diſorder: let a piece of thick flannel be moiſtened with equal parts of any common oil and of ſpirit of hartſhorn, and applied to the throat, to be renewed once in four or five hours: this medicine, he tells us, he had from Dr. Young, phyſician in Edinburgh. By means of this application, the neck, and ſometimes the whole body, is put into a ſweat; which, after bleeding, either carries off or leſſens the inflammation. He alſo tells us, that he has obſerved little benefit ariſing from gargles, and that the acid ones did more harm than good; however, a decoction of figs in milk and water, eſpecially if the ſpirit of ſal ammoniac be added, ſerves to thin the ſaliva, whereby the glands ſecrete more freely; a circumſtance always conducive to the cure.

In the Philoſophical Tranſactions, the jelly of black currants, ſwallowed down leiſurely in ſmall quantities, is aſſerted to be a ſpecific for a quinzy; and a decoction of the leaves or bark in milk, when the jelly cannot be had, uſed as a gargle, is ſaid to cure all the inflammatory diſtempers of the throat that happen in the winter time.

In malignant fevers, when there is an inflammation of the œſophagus, *Hoffman* orders to take nitre, one dram; camphor, three grains; ſugar, one ounce; make a powder, which is to be given in an emulſion of ſweet almonds, and may alſo be held in the mouth for ſome time before it is ſwallowed. That inflammatory pain which ariſes from a ſharp ſalt ſerum in the glandulous parts of the fauces with redneſs and a copious flux of ſaliva, but without a fever, may be cured with a gargle of brandy alone. When there is a large defluxion of an impure ſerous humour upon the fauces, it requires a frequent uſe of gentle laxatives. When the ſymptoms of a quinzy are ſo urgent, that the patient is in immediate danger of ſtrangling, recourſe muſt be had to bronchotomy, or opening of the wind-pipe.

QUINK, in building, a piece of ground taken out of any regular ground-plot, or floor: thus if the ground-plot were oblong or ſquare, a piece taken out of a corner to make a court or yard, &c. is called a quink.

QUIRE of paper, the quantity of twenty-four or twenty-five ſheets.

QUIRISTER, or CHOIRISTER, a perſon appointed to ſing in the choir of a cathedral.

QUIT-RENT, in law, a ſmall rent that is payable by the tenants of moſt manors, whereby the tenant goes quit and free from all other ſervices; and it is ſaid to be an acknowledgement, in token of ſubjection to the lord. Anciently this payment was called white rent, on account that it was paid in ſilver coin, and to diſtinguiſh it from rent-corn.

QUITTER-BONE, among farriers, the ſame with crotches. See CROTCHES.

QUOINS, in architecture, denote the corners of brick or ſtone walls. The word is particularly uſed for the ſtones in the corners of brick-buildings. When theſe ſtand out beyond the brick-work, their edges being chamfered off, they are called ruſtic quoins.

QUORUM, a word frequently mentioned in our ſtatutes, and in commiſſions both of juſtices of the peace and others. It is thus called from the words of the commiſſion, *quorum* A. B. *unum eſſe volumus*. For an example, where a commiſſion is directed to ſeven perſons, or to any three of them, whereof A. B. and C. D. are to be two; in this caſe, they are ſaid to be of the quorum, becauſe the reſt cannot proceed without them: ſo a juſtice of the peace and quorum is one without whom the reſt of the juſtices in ſome caſes cannot proceed.

QUOTATION, in literature, a citation, or paſſage, rehearſed expreſsly in one author from another.

QUOTATIONS are uſually diſtinguiſhed by inverted commas.

QUOTIDIAN, *Quotidiana*, in medicine, an intermitting fever, or ague, the paroxyſm or fit whereof returns every day.

This ſpecies of intermittent fevers is not ſo common as the tertian and quartan.

It attacks the patient early in the morning, with chilneſs and ſhivering; to which ſucceed a cardialgia, nauſea, and inflation of the belly; in ſome a pain in the head, in others fainting fits, and in moſt vomiting or ſtools, or both; after which comes on the hot fit, with thirſt.

As to the cure, the beſt method ſeems to be firſt to attenuate the tough and vitiated humours in the ſtomach and inteſtines, by proper doſes of vitriolated tartar, and the like; after which a gentle emetic, diaphoretics and diluents are to be adminiſtered; and laſtly, the bowels are to be ſtrengthened by bitters and ſub-aſtringents; among which, the Peruvian bark claims a place, only to be uſed in ſmaller quantities than when truſted to alone for the cure.

QUOTIENT, in arithmetic, the number which ariſes by dividing the dividend by the diviſor. See DIVISION.

QUO WARRANTO, in law, a writ which lies againſt a perſon or corporation, that uſurps any franchiſe or liberty againſt the king; as to have a fair, market, or the like, in order to oblige the uſurper to ſhew by what right and title he holds or claims ſuch franchiſe.

This writ alſo lies for miſ-uſer, or non-uſer of privileges granted.

R.

RAB

R, a liquid conſonant, and the ſeventeenth letter of the alphabet.

The grammarians hold it for a ſemi-vowel, eſpecially in the Greek, where it admits an aſperate.

The Hebrews allow it the privilege of a guttural, that is, they never double it, which yet is done by the Arabs, Greeks, Latins, &c.

Its ſound is formed by a guttural extruſion of the breath, vibrated through the mouth, with a ſort of quivering motion of the tongue drawn from the teeth, and cannulated with the tip a little elevated towards the palate.

It has but one ſound, and is followed by an *h* in Greek words, as *rhapſody*, *rhetoric*, &c. otherwiſe it is always followed by a vowel at the beginning of words and ſyllables.

Uſed as a numeral, R anciently ſtood for 80, and with a daſh over it, thus, $\bar{R}$, 80,000; but the Greek *r*, or ρ, ſignified 100.

In the preſcriptions of phyſicians, R or ℞ ſtands for *recipe*, that is, take.

RABBETING, in carpentry, the planning, or cutting of channels or grooves in boards, &c.

In ſhip-carpentry, it ſignifies the letting in of the planks of the ſhip into the keel; which, in the rake and run of a ſhip, is hollowed away, that the planks may join the cloſer.

RABBI, or RABBINS, a title which the Phariſees and doctors of the law among the Jews aſſumed, and literally ſignifies maſters or excellents.

There were ſeveral gradations before they arrived at the dignity of a rabbin, which was not conferred till they had acquired the profoundeſt knowledge of the law and the traditions. It does not however appear that there was any fixed age, or previous examination neceſſary; but when a man had diſtinguiſhed himſelf by his ſkill in the written and oral law, and paſſed through the ſubordinate degrees, he was ſaluted a rabbin by the public voice.

Among the modern Jews, for near ſeven hundred years paſt, the learned men retain no other title than that of rabbi, or rabbins: they have great reſpect paid them, have the firſt places or ſeats in their ſynagogues, determine all matters of controverſy, and frequently pronounce upon civil affairs: they have even a power to excommunicate the diſobedient.

RABBINET, a ſmall piece of ordnance, between a falconet and a baſe. See CANNON.

RABBINISTS, among the modern Jews, an appellation given to the doctrine of the Rabbins concerning traditions, in oppoſition to the Caraites, who reject all traditions.

RABBIT, *Cuniculus*, in zoology, a well known animal of the lepus, or hare kind, with a very ſhort tail.

The female or doe rabbit goes with young thirty days, and then ſhe kindles; and if ſhe take not buck preſently ſhe loſes her month, or at leaſt a fortnight, and often kills her young and eats them.

In England they begin to breed at a year old, but in ſome places much ſooner; and they continue breeding very faſt from the time when they begin, four, five, ſix, or ſeven times a year being common with them. They have uſually from four to ſeven in a litter, and hence it is that a ſmall number at firſt will ſoon ſtock a whole warren, if left to breed a little while undiſturbed. The does cannot ſuckle their young till they have been at buck again: this therefore is to be done preſently, elſe there is a fortnight loſt of the time for the next brood, and the preſent brood alſo probably loſt. When the buck goes to the doe, he always beats and ſtamps very hard with his feet, and, when he has copulated with her, he falls backwards, and lies as it were in a trance; in this ſtate it is eaſy to take him, but he ſoon recovers from it.

The buck rabbits, like our boar cats, will kill the young ones, if they can get at them; and the does in the warrens prevent this, by covering their ſtocks, or neſts, with gravel or earth, which they cloſe ſo artificially up with the hinder part of their bodies, that it is hard to find them out. They never ſuckle the young ones at any other time than early in the morning, and late at night, and always, for eight or ten days, cloſe up the hole at the mouth of the neſt, in this careful manner, when they go out. After this, they begin to leave a ſmall opening, which they increaſe by degrees, till at length, when they are about three weeks old, the mouth of the hole is left wholly open, that they may go out: for they are at that time grown big enough to take care of themſelves, and to feed on graſs.

People who keep rabbits tame for profit, breed them in hutches, but theſe muſt be kept very neat and clean, otherwiſe they will be always ſubject to diſeaſes. Care muſt be taken alſo to keep the bucks and does apart till the latter have juſt kindled, then they are to be turned to the bucks again, and to remain with them till they ſhun and run from them.

The general direction for the chooſing of tame rabbits is, to pick the largeſt and faireſt; but the breeder ſhould remember that the ſkins of the ſilver-haired ones ſell better than any other. The food of the tame rabbits may be colewort and cabbage leaves, carrots, parſnips, apple-rinds, green corn, and vetches, in the time of the year; alſo vine leaves, graſs, fruit, oats, and oatmeal, milk-thiſtles, ſow-thiſtles, and the like; but with theſe moiſt foods they muſt always have a proportionable quantity of the dry foods, as hay, bread, oats, bran, and the like, otherwiſe they will grow pot-bellied, and die. Bran and grains mixed together have been alſo found to be very good food. In winter they will eat hay, oats, and chaff, and theſe may be given them three times a day; but when they eat green things, it muſt be obſerved that they are not to drink at all, for it throws them into a dropſy. At all other times a very little drink ſerves their turn, but that muſt always be freſh. When any green herbs or graſs are cut for their food, care muſt be taken that there is no hemlock among it, for, though they will

eat this greedily among other things, when offered to them, yet it is ſudden poiſon to them.

Rabbits are ſubject to two principal infirmities. Firſt, the rot, which is cauſed by the giving them too large a quantity of greens, or from the giving them freſh gathered, with the dew or rain hanging in drops upon them. It is over moiſture that always cauſes this diſeaſe; the greens therefore are always to be given dry, and a ſufficient quantity of hay, or other dry food, intermixed with them, to take up the abundant moiſture of their juices. On this account the very beſt food that can be given them, is the ſhorteſt and ſweeteſt hay that can be got, of which one load will ſerve two hundred couples a year; and out of this ſtock of two hundred, two hundred more may be eat in the family, two hundred ſold to the markets, and a ſufficient number kept in caſe of accidents.

The other general diſeaſe of theſe creatures is a ſort of madneſs: this may be known by their wallowing and tumbling about with their heels upwards, and hopping in an odd manner into their boxes. This diſtemper is ſuppoſed to be owing to the rankneſs of their feeding; and the general cure is the keeping them low, and giving them the prickly herb, called tare-thiſtle, to eat.

The general computation of males and females is, that one buck rabbit will ſerve for nine does; ſome allow ten to one buck, but thoſe who go beyond this always ſuffer for it in their breed.

The wild rabbits are to be taken either by ſmall cur dogs, or by ſpaniels bred up to the ſport; and the place of hunting thoſe who ſtraggle from their burrows is under cloſe hedges, or buſhes, or among corn-fields and freſh paſtures. The owners uſe to courſe them with ſmall greyhounds, and, though they are ſeldom killed this way, yet they are driven back to their burrows, and are prevented from being a prey to others. The common method is by nets, called purſe nets, and ferrets. The ferret is ſent into a hole to force them out, and the purſe net, being ſpread over the hole, takes them, as they come out. The ferret's mouth muſt be muffled, and then the rabbit gets no harm. For the more certain taking of them, it may not be improper to pitch up a hay net or two, at a ſmall diſtance from the burrows that are intended to be hunted: thus very few of the number that are attempted will eſcape.

Some who have not ferrets ſmoak the rabbits out of their holes with burning brimſtone and orpiment. This certainly brings them out into the nets, but then it is a very troubleſome and offenſive method, and is very detrimental to the place, as no rabbit will, of a long time, afterwards come near the burrows which have been fumed with theſe ſtinking ingredients.

RABBET, in ſhip-building, when a plank is to be faſtened to any piece of timber, ſuch as the ſtern or poſt, there is ſo much wood cut out of the piece as the plank is thick, whch is called the rabbet; and when the plank is let into this rabbet it will be even with the outſide of the piece, as at the after-end of the keel, and lower-end of the ſtern-poſt. *Murray's Ship-building.*

RACK, in the manege, a pace in which a horſe neither trots nor ambles, but ſhuffles as it were between.

RACK is alſo a wooden frame made to hold hay or fodder for cattle.

RACK, an engine of torture, furniſhed with pullies and cords, &c. for extorting confeſſions from criminals.

RACK, ARAC, or ARRAC, in commerce, a ſpirituous liquor made by the Tartars of Tonguſia, who are ſubject to the czarina of Muſcovy. This kind of rack is made of mares-milk, which is left to be ſour, and afterwards diſtilled twice or thrice between two earthen pots cloſely ſtopped, from whence the liquor runs through a ſmall wooden pipe. This liquor is more intoxicating than brandy diſtilled from wine.

Rack is alſo a ſpirituous liquor which the Engliſh get from Batavia or Malacca, of which there are three ſorts; the one being extracted from the cocoa-tree, the ſecond from rice, and the third from ſugar: but the firſt is the beſt and moſt in uſe. It is made of the bloſſom-bunch of the cocoa tree; for which purpoſe they tye the bunch while it is ſtill wrapped up within its cod, or membrane, with a piece of packthread, and then with a knife make a croſs cut in that bunch, a little above the place where it is tied, and adapt a pitcher to it to receive the liquor, which is called toddy, and is vinous, palatable, and ſweet: others uſe a bamboe-cane inſtead of a pitcher. Having thus drawn the liquor, they let it ferment, and afterwards diſtil it.

Goa and Batavia are the chief places for rack. At Goa there are ſeveral kinds; ſingle, double, and treble diſtilled; but the double diſtilled, which is that commonly ſent abroad, is but a weak ſpirit when compared with Batavia rack; yet, on account of its peculiar and agreeable flavour, it is preferred to all the other racks of India. The Prior rack, made at Madras, the Columbo and Quilone rack, being fiery hot ſpirits, are but little valued by the Europeans, and therefore ſeldom imported, though they are highly prized among the natives.

To RACK *wines*, &c. to draw them off from their lees, after having ſtood long enough to clear and ſettle.

Hence rack-vintage is frequently uſed for the ſecond voyage our wine-merchants uſed to make into France for racked-wines.

RACKET, a kind of bat to ſtrike the ball with at tennis; uſually conſiſting of a lattice or net-work of cat-gut ſtrained very tight in a circle of wood, with a ſhaft or handle.

RACKET is alſo a kind of ſnow-ſhoe, or machine, which the ſavages of Canada bind to their feet, to enable them to walk more commodiouſly on the ſnow; made much in the manner of a tennis racket.

RACKING, or RAGGING, the tackles, in the ſea language, the act of ſeizing or faſtening two oppoſite parts of a pulley together, to prevent them from running through the blocks.

When a veſſel rides in an open road or harbour, where it is apprehended the crew may ſeize the boats to deſert, it is uſual to hoiſt the boats up to the upper part of the ſhip's ſide in the evening, and to let them hang by the tackles all night. But leſt any one through negligence ſhould looſen the rope of the tackle, ſo as to let the boat, or one end of it, fall into the ſea, the tackles are racked or tied together above the blocks.

RACKOON, *Coati*, in zoology, an American quadruped of the ſhape of a beaver, only ſomewhat ſmaller, and with the hair like that of a fox, only that the ears are ſhorter, roundiſh, and naked; its tail is longer than its body, and not unlike that of a cat, with annular ſtreaks of different colours.

RADIAL CURVES, are curves of the ſpiral kind, whoſe ordinates, if they may be ſo called, all terminate in the center of the including circle, appearing like radii of that circle, whence the name. See the articles CURVE and SPIRAL.

RADIALIS, or RADIÆUS, in anatomy, the name of two muſcles of the arm, one of which, called radialis internus, is one of the three flexor muſcles of the carpus, or hand, which ariſing from the internal condyle of the humerus, is inſerted into the bone of the carpus next the thumb; and the other, called radialis externus, is one of the three extenſor muſcles of the hand, which ariſing from the external condyle of the humerus, is inſerted into the firſt metacarpal bone.

RADIANT, or RADIATING POINT, in optics, is any point of a viſible object, from whence rays proceed.

RADIATED FLOWERS, in botany, ſuch as have ſeveral ſemi-floſcules round a diſk, in form of a radiant ſtar: thoſe which have no ſuch rays are called diſcous flowers.

The term radiated is alſo uſed with reſpect to one of the ancient crowns. See CROWN.

RADIATION, the act of a body emitting or diffuſing rays of light all round, as from a center.

RADICAL, in general, ſomething that ſerves as a baſis or foundation.

In grammar, we give the appellation radical to primitive words, in contradiſtinction to compounds and derivatives.

Algebraiſts alſo ſpeak of the radical ſign of quantities, which is the character expreſſing their roots.

RADICLE, that part of the ſeeds of all plants, which upon vegetating becomes its root, and is diſcoverable by the microſcope.

RADIOMETER, an inſtrument otherwiſe called the fore-ſtaff. See FORE-STAFF.

RADISH, *Raphanus*, in botany, a genus of plants, the flower of which conſiſts of four leaves, which are placed in form of a croſs: out of the flower cup riſes the pointal, which afterwards turns to a pod in form of an horn, that is thick, ſpongy, and furniſhed with a double row of roundiſh ſeeds, which are ſeparated by a thin membrane.

There are ſeveral ſpecies of radiſh, but we ſhall only mention that which is commonly cultivated in kitchen-gardens for its root; of which there are ſeveral varieties, as the ſmall-topped, the deep-red, and the long-topped ſtriped radiſh; all which are varieties ariſing from culture. The ſmall-topped ſort is moſt commonly preferred by the gardeners near London, becauſe they require much leſs room than thoſe with large tops, and may be left much cloſer together; and, as the forward radiſhes are what produce the greateſt profit to the gardener, ſo theſe being commonly ſown upon borders near hedges, walls, or pales, if they are of the large-topped ſort, they will be apt to grow moſtly at top, and not ſwell ſo much in the root as the other, eſpecially if they are left pretty cloſe.

The ſeaſons for ſowing this ſeed are various, according to the time when they are deſired for uſe; but the earlieſt ſeaſon is commonly towards the latter end of October, that the gardeners near London ſow them to ſupply the market; and theſe, if they do not miſcarry, will be fit for uſe in March following, which is full as ſoon as moſt people care to eat them. Theſe, as I ſaid beſore, are commonly ſown on warm borders, near walls, pales, or hedges, where they may be defended from the cold winds.

The ſecond ſowing is commonly about Chriſtmas, provided the ſeaſon be mild, and the ground in a fit condition to work: theſe are alſo ſowed near ſhelter, but not ſo near pales and hedges as the firſt ſowing. Theſe, if they are not deſtroyed by froſt, will be fit for uſe the beginning of April: but, in order to have a ſucceſſion of theſe roots for the table through the ſeaſon, you ſhould repeat ſowing of their ſeeds once a fortnight, from the middle of January till the beginning of April; always obſerving to ſow the latter crops upon a moiſt ſoil and an open ſituation, otherwiſe they will run up, and grow ſickly, before they are fit for uſe.

Many of the gardeners near London ſow carrot-ſeed with their early radiſhes; ſo that many times, when their radiſhes are killed, the carrots will remain: for the ſeeds of carrots commonly lie in the ground five or ſix weeks before they come up, and the radiſhes ſeldom lie above a fortnight under-ground: ſo that theſe are often up, and killed, when the carrot ſeed remains ſafe in the ground: but, when both crops ſucceed, the radiſhes muſt be drawn off very young, otherwiſe the carrots will be drawn up ſo weak, as not to be able to ſupport themſelves, when the radiſhes are gone.

It is alſo a conſtant practice with the gardeners, to mix ſpinach-ſeed with their latter crop of radiſhes; ſo that, when the radiſhes are drawn off, and the ground cleaned between the ſpinach, it will grow prodigiouſly, and in a fortnight's time will as completely cover the ground, as though there had been no other crop. And this ſpinach, if it be of the broad-leaved kind, will be larger and fairer than it commonly is, when ſown by itſelf; becauſe, where people have no other crop mixed with it, they commonly ſow it too thick, whereby it is drawn up weak; but here the roots ſtand pretty far apart, ſo that, after the radiſhes are gone, they will have full room to ſpread; and, if the ſoil be good, it is a prodigious ſize this ſpinach will grow to, before it runs up for ſeed: but this huſbandry is chiefly practiſed by ſuch gardeners as pay very dear for their land, and are obliged to have as many crops in a year as poſſible, otherwiſe they could not afford to pay ſuch large rents.

When the radiſhes are come up, and have got five or ſix leaves, they muſt be pulled up where they are too cloſe, otherwiſe they will draw up to top, but the roots will not increaſe their bulk. In doing of this, ſome only draw them out by hand: but the beſt method is to hoe them with a ſmall hoe, which will ſtir the ground and deſtroy the young weeds, and alſo promote the growth of the plants. The diſtance which they ſhould be left, if for drawing up ſmall, may be three inches; but, if they are to ſtand until they are pretty large, ſix inches are full near enough, and a ſmall ſpot of ground will afford as many radiſhes at each ſowing, as can be ſpent in a family, while they are good.

Horſe RADISH, a well known plant, belonging to the genus cochlearia.

Horſe radiſh is propagated by cuttings or buds from the ſides of the old roots. The beſt ſeaſon for this work is in October or February; the former for dry lands, and the latter for moiſt. The manner of doing it is as follows: Provide yourſelf with a good quantity of off-ſets, which ſhould have a bud upon their crowns; but it matters not how ſhort they are: therefore, the upper part of the roots which are taken up for uſe, ſhould be cut off about two inches long with the bud to it, which is eſteemed the beſt for planting. Then make a trench ten inches deep, in which you ſhould place the off-ſets at about four or five inches diſtance each way, with the bud upward, covering them up with the mould that was taken out of the trench: then proceed to a ſecond trench in like manner, and continue the ſame until the whole ſpot of ground is planted. After this, level the ſurface of the ground even, obſerving to keep it clear from weeds, until the plants are ſo far advanced, as to be ſtrong enough to over-bear and keep them down. With this management, the roots of the horſe radiſh will be long and ſtraight, and free from ſmall lateral roots; and the ſecond year after planting will be fit for uſe. It is true, they may be taken up the firſt year, but then the roots will be but ſlender; therefore it is the better way to let them remain until the ſecond year. The ground in which this is planted ought to be very rich, otherwiſe the roots will make but a ſmall progreſs.

Radiſhes have the virtues of the ſcurvy graſs; the root is eſculent, expels phlegm from the inteſtines, and is a carminative. The flowers, leaves, ſeeds, and roots, are antiſcorbutic; for which reaſon they are much in requeſt, and are proper for phlegmatic conſtitutions: the expreſſed juice of the roots and ſeeds, taken in a morning with honey, is a very wholſome medicine, eſpecially if a draught of whey be taken afterwards; for it cleanſes the ſtomach, kidnies, and lungs, and is good againſt an inveterate cough and hoarſeneſs, proceeding from phlegm; but it is not proper in a cough proceeding from an inflammation, nor for thoſe who ſpit blood. The leaves are uſed among other greens. The root contains much of an acrimonious ſubſtance: and, the drier it is, the more acrid it becomes; but its acrimony is loſt in boiling. Its aquoſity renders it flatulent, on which account it is ſaid not to be good in hypochondriacal diſorders; the daily uſe of the root, however, is of ſufficient efficacy to cure a great dropſy in the beginning; and it is of excellent ſervice in the ſcurvy. It is alſo aperitive, inciding, and good for the ſtone, the nephritic cholic, a retention of urine, and the menſes, and in the jaundice. The ſeeds are opening; but taken inwardly by themſelves, they excite a nauſea. *Hiſt. Plant. aſcript. Boerhaave.*

RADIUS, in geometry, the ſemi-diameter of a circle, or a right line drawn from the center to the circumference. See CIRCLE.

In trigonometry, the radius is termed the whole ſine, or ſine of 90°. See SINE.

RADIUS, in anatomy, the exterior bone of the arm, deſcending along with the ulna, from the elbow to the wriſt.

RADIX, the ſame with root. See the article ROOT.

RAFT, amongſt ſailors, a ſort of float conſiſting of a number of poles or planks, firmly tied together alongſide of each other, to be conveyed to any diſtant place in a river, or to lade a ſhip.

In ſeveral roads of the Baltic ſea the floats of timber, or planks, are towed to the ſhips in this manner.

RAFT-PORT, a large ſquare port, or hole, cut thro' the buttock of a ſhip, under the counter, to receive the planks, or timber, which comes aboard on the raft. They are drawn into the ſhip thus longitudinally, becauſe they

they cannot be let down through the hatches on account of their extreme length.

RAFTERS, in building, are pieces of timber, which ſtanding by pairs on the reaſon or raiſing piece, meet in an angle at the top, and form the roof of a building. It is a rule in building that no rafters ſhould ſtand farther than twelve inches from one another; and, as to their ſizes or ſcantlings, it is provided by act of parliament, that principal rafters, from twelve feet ſix inches to fourteen feet ſix inches long, be five inches broad at the top and eight at the bottom, and ſix inches thick. Thoſe from fourteen feet ſix inches to eighteen feet ſix inches long, to be nine inches broad at the foot, ſeven inches at the top, and ſeven inches thick; and thoſe from eighteen feet ſix inches, to twenty-one feet ſix inches long, to be ten inches broad at the foot, eight at the top, and eight thick. Single rafters, eight feet in length, muſt have four inches and a half, and three inches three quarters in their ſquare. Thoſe of nine feet long muſt be five and four inches ſquare.

Principal rafters ſhould be nearly as thick at the bottom as the beam, and ſhould diminiſh in their length one fifth or one ſixth of their breadth; the king-poſts ſhould be as thick as the principal rafters, and their breadth according to the bigneſs of them that are intended to be let into them, the middle part being left ſomewhat broader than the thickneſs.

RAG, or RAKE, a company, or herd of young colts.

RAG-BOLT, in ſhip-building, a long cylindrical pin of iron to drive through the plank into the timbers on particular occaſions; the inward end of it is ragged, or full of little barbs, to prevent them from drawing back by the working of the ſhip.

RAGULED, or RAGGED, in heraldry, jagged or knotted. This term is applied to a croſs formed of the trunks of two trees without their branches, of which they ſhew only the ſtumps.

RAJA, the title of the Indian black princes, the remains of thoſe who ruled there before the moguls.

RAIL, in architecture, denotes thoſe pieces of timber which lie horizontally between the pannels of wainſcot.

It is alſo applied to thoſe pieces of timber which lie over and under ballufters in balconies, ſtair-caſes, &c. as alſo from poſt to poſt in fences with pales or without.

RAILS, in ſhip-building, are narrow planks generally of fir, upon which there is a moulding ſtruck. They are for ornament, and nailed acroſs the ſtern above the wing-tranſom, and counters, &c. They are likewiſe nailed upon ſeveral planks along the ſides; one in particular is called the ſheet-rail, which limits the height of the ſide from the fore-caſtle to the quarter-deck, and run aft to the ſtern, and forward to the cat-head. The wales are nearly parallel to this. *Murray's Ship Building.*

There are alſo other rails above the deck, ranging fore and aft, to prevent the men from falling over into the ſea. Such are the fifth-rail, quarter-rails, ſtern and fore-caſtle-rials. See the article QUARTER.

RAIN, a watery meteor, which deſcends from the clouds in form of drops of water.

Rain is apparently the precipitated vapours of watery clouds: thus, when various congeries of clouds are driven together by the agitation of the winds, they mix and run into one body, and by that means diſſolve and condenſe each other into their former ſubſtance of water; alſo the coldneſs of the air is a great means to collect, compact, and condenſe clouds into water; which being heavier than the air, muſt of neceſſity fall through it in the form we call rain. Now the reaſon why it falls in drops, and not in whole quantities, as it becomes condenſed, is the reſiſtance of the air; whereby, being broken and divided into ſmaller and ſmaller parts, the farther it paſſes through the air, it at laſt arrives to us in ſmall drops.

Mr. Derham accounts for the precipitation hence, that the veſiculæ being full of air, when they meet with a colder air than that they contain, their air is contracted into a leſs ſpace; and, conſequently, the watery ſhell rendered thicker, ſo as to become heavier than the air, &c.

Others only allow the cold a part in the action, and bring in the winds as ſharers with it: indeed, it is plain, that a wind, blowing againſt a cloud, will drive its veſiculæ upon one another, by which means ſeveral of them coaleſcing, will be enabled to deſcend; and the effect will be ſtill more conſiderable if two oppoſite winds blow towards the ſame place. Add to this, that clouds already formed, happening to be aggravated by freſh acceſſions of vapour continually aſcending, may thence be enabled to deſcend.

According to Rohault, the great cauſe of rain is the heat of the air, which, after continuing for ſome time near the earth, is at length carried up on high by a wind, and there thawing the ſnowy villi, or flocks of the half frozen veſiculæ, reduces them into drops; which, coaleſcing, deſcend.

Others, as Dr. Clarke, &c. aſcribe this deſcent of the clouds rather to an alteration of the atmoſphere than of the veſiculæ; and ſuppoſe it to ariſe from a diminution of the elaſtic force of the air. This elaſticity, which depends chiefly or wholly on the terrene exhalations, being weakened, the atmoſphere ſinks under its burden, and the clouds fall.

Now the little veſicules, being once upon the deſcent, will perſiſt therein, notwithſtanding the increaſe of reſiſtance they every moment meet with. For as they all tend toward the center of the earth, the farther they fall, the more coalitions will they make; and the more coalitions, the more matter will there be under the ſame ſurface; the ſurface only increaſing as the ſquares, but the ſolidity as the cube; and the more matter under the ſame ſurface, the leſs reſiſtance there will be to the ſame matter. Thus, if the cold, wind, &c. act early enough to precipitate the aſcending veſicules, before they are arrived at any conſiderable height, the coalitions being but few, the drops will be proportionably ſmall; and thus is formed a dew. If the vapours be more copious, and riſe a little higher, we have a miſt or fog. A little higher ſtill, and they produce a ſmall rain, &c. If they neither meet with cold nor wind, they form a heavy, thick, dark ſky.

Hence, many of the phœnomena of the weather may be accounted for: as, Why a cold ſummer is always a wet one, and a warm, a dry one? Why we have commonly moſt rain about the equinoxes? Why a ſettled, thick, cloſe ſky, ſcarce ever rains, till it have been firſt clear?

As to the quantity of rain that falls, its proportion in ſeveral places at the ſame time, and in the ſame place at ſeveral times, we have ſtore of obſervations, journals, &c. in the Memoirs of the French Academy, Philoſophical Tranſactions, &c.

Preternatural RAINS, as of blood, are very frequent in our annals, and even in natural hiſtories; yet, if enquired into, they will be found other things than rain.

Thoſe rains, Dr. Merret obſerves, are nothing more than the excrements of inſects, as butterflies, &c.

The ſame gentleman adds, that it is very evident the rains of wheat are nothing but ivy-berries ſwallowed by the ſtarling, and voided again by ſtool. See an inſtance of ſuch rain in the Philoſophical Tranſactions.

RAINBOW, or *Bow*, *Iris*, a meteor, in form of a party-coloured ſemi-circle, exhibited in a rainy ſky oppoſite to the ſun, by the refraction of his rays in drops of falling rain.

There is, alſo, a ſecondary bow which is fainter, uſually inveſting the former at ſome diſtance.

The rainbow, Sir Iſaac Newton obſerves, never appears but where it rains in the ſun-ſhine; and may be repreſented artificially, by contriving water to fall in little drops, like rain, through which the ſun, ſhining, exhibits a bow to a ſpectator placed between the ſun and the drops; eſpecially, if a black cloth be diſpoſed beyond the drops.

Anton. de Dominis firſt accounted for the rainbow in 1611, by refraction and reflexion of the ſun-beams in ſpherical drops of water; which he confirmed by experiments made with glaſs globes, &c. full of water; wherein he was followed by Des Cartes, who improved upon his account. But the Newtonian doctrine of colours ſupplies and corrects their explications.

Theory

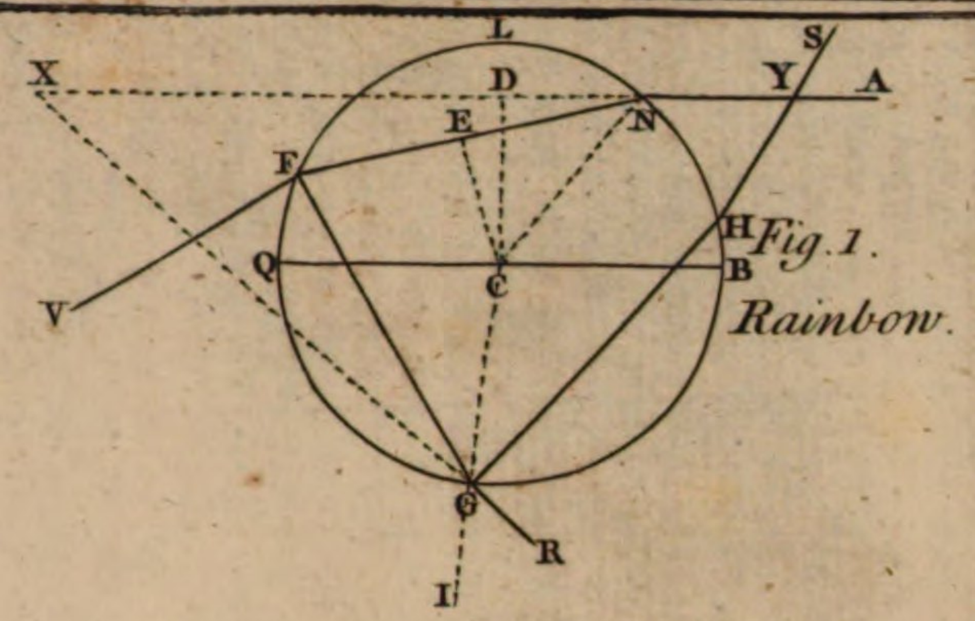


Fig. 1. Rainbow.

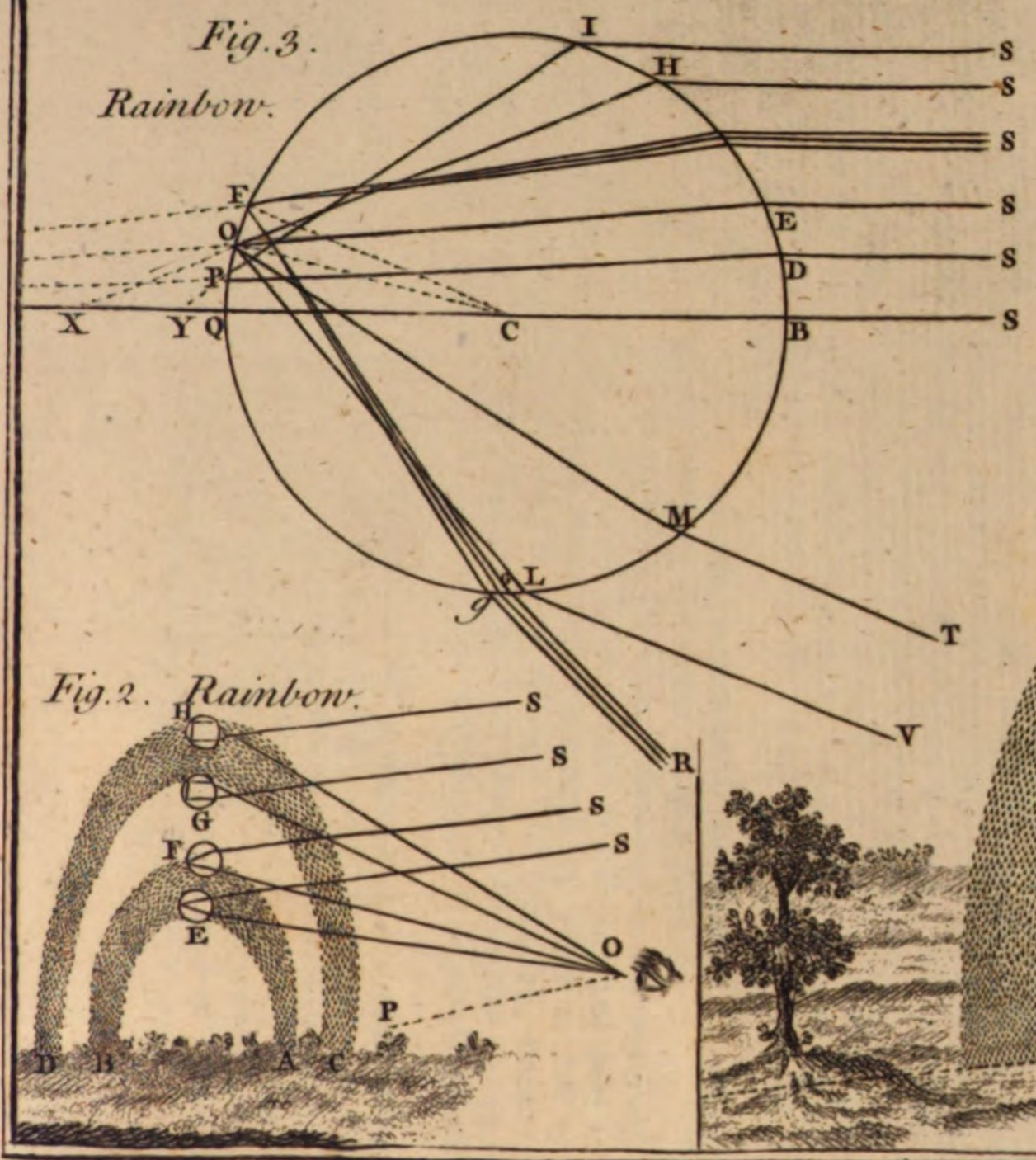


Fig. 3. Rainbow.

Fig. 2. Rainbow.

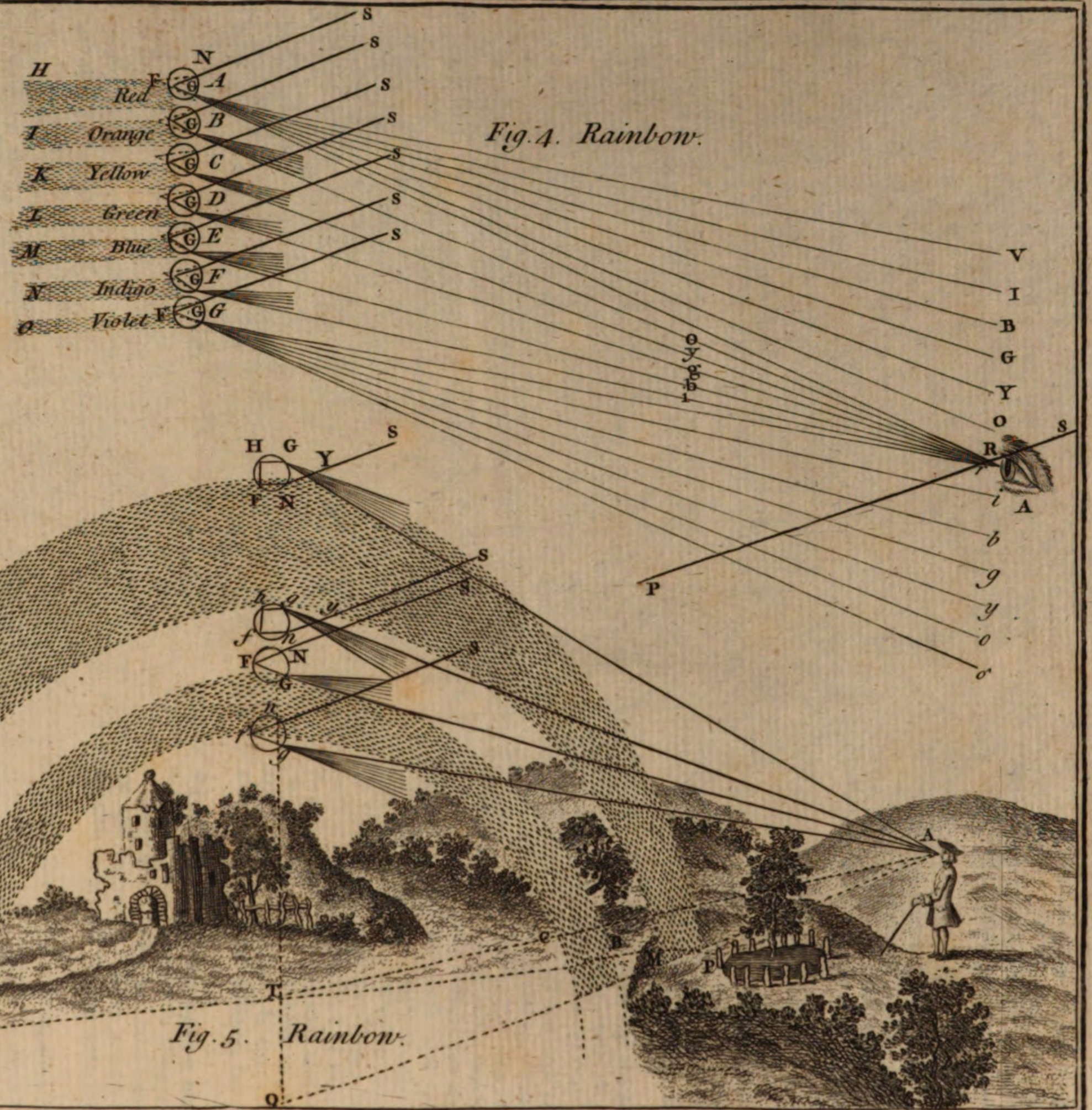


Fig. 4. Rainbow.

Fig. 5. Rainbow.

Theory of the RAINBOW.—Let B N F G (plate CVIII. *fig.* 1.) be a ſpherical drop of falling rain, and A N a ray of the ſun falling upon it in the point N, which ray ſuppoſe refracted to F, from thence reflected to G, and there again refracted in the direction G R to the eye of a ſpectator; and let I G be perpendicular to the point G: Then will the beam, by its refraction at G, be ſeparated into its ſeveral ſorts of rays, which will paint their reſpective colours in that part of the drop, of which that next the perpendicular I G will be red, as being leaſt refracted, and the reſt, in order, above it. Now, it is found by computation, that the greateſt angle S E O (*fig.* 2.) or E O P (drawing O P parallel to S E) under which the moſt refrangible rays can come to the eye of a ſpectator at O, is 40 deg. 17 min. and that the greateſt angle F O P, under which the leaſt refrangible rays come to the eye at O, is 42 deg. 2 min. And ſo all the particles of water within the difference of thoſe two angles E F, will exhibit, ſeverally, the various colours of the priſm, and conſtitute the interior bow in the cloud.

If the beam go not out of the drop at G (*fig.* 1.) but is reflected (a ſecond time) to H, and is there refracted in the direction H S, making the angle S Y A with the incident ray A N, it will paint on the part H the ſeveral colours of light, but in an inverſe order to the former, and more faint, by reaſon of the rays loſt by the ſecond reflection. It has been found, alſo, that the leaſt angle S G O, or G O P (*fig.* 2.) under which the leaſt refrangible rays can come to the eye at O, after two reflections and two refractions, is 50 deg. 57. min. and the leaſt angle H O P, under which the moſt refrangible rays can come to the eye in this caſe, is 54 deg. 7 min. Whence all the colours of the exterior bow will be formed in the drops from G to H, which is the breadth of this bow, viz. 3 deg. 10 min. whereas the breadth of the other, viz. E F, is but 1 deg. 45 min. and the diſtance between the bows, viz. F G, is 8 deg. 55 min. And ſuch would be the meaſure of the bows, were the ſun but a point; but ſince his body ſubtends an angle of half a deg. it is evident, by ſo much each bow will be increaſed, and their diſtance diminiſhed.

To apprehend rightly the different affections of this remarkable phænomenon, we muſt attend to the following particulars: Firſt, That though each bow be occaſioned by the refracted and reflected light of the ſun falling on the drops of rain, yet neither of them is produced by any rays falling on any part of the drop indifferently, but by thoſe only which fall on the ſurface of the drop B L Q G (*fig.* 1.) in or about the point N, as the ray A N; thoſe which fall nearer to B, or farther towards L, being unconcerned in this production.

Secondly, The internal bow is produced by two refractions, and one reflection. The firſt reflection is of the incident rays extremely near A N, by which they proceed from N to one common point or focus at F, from whence they are reflected to G, and are there a ſecond time refracted towards R, and produce the various colours of the ſaid bow.

Thirdly, There is a neceſſity that ſeveral rays ſhould be refracted together to the point F (*fig.* 3.) that being reflected together from thence to G, they may there go out parallel, and ſo come in quantity ſufficient to excite the ſenſation of colours in a ſtrong and lively manner. Now thoſe rays, and thoſe only, which are incident on the globule about the point N, can do this, as will appear from what follows: for,

Fourthly, The point F makes the arch Q F a maximum, or the diſtance Q F from the axis of the drop S Q is greater than any other diſtance from whence any other rays nearer to the axis, as S D, S E, or farther from it, as S H, S I, are reflected; becauſe thoſe which are nearer after the firſt refraction tend to points in the axis produced more remote than that to which the ray S N tends; and, therefore, as their diſtance from the axis increaſes, ſo, likewiſe, will the diſtances of their points of reflection Q P, Q O, till the ray becomes S N; after which, the rays more remote from the axis, as S H, S I, are refracted towards the points X Y, which are nearer and nearer to the axis: And this occaſions the points of the reflection on the fartheſt ſide of the drop to decreaſe again from F towards Q.

Fifthly, Hence it will neceſſarily happen, that ſome rays above and below the ray S N will fall upon the ſame point, as O or P on the fartheſt ſide; and, for that reaſon, they will be ſo reflected from thence, as to go out of the drop by refraction parallel to each other. Thus, let S E below, and S H above the ray S N, be refracted both to one point O; from whence they will be reflected to M and L, and will there emerge parallel, it is true, but alone; being diveſted of their intermediate rays S N, which, going to a different point F, will be reflected in a different direction to G, and emerge on one ſide, and not between thoſe rays, as when they were incident on the drop. All which is evident from the figure.

Sixthly, As this will be the caſe of all the rays which are not indefinitely near to S N, it is plain, that being deprived of the intermediate rays, their denſity will be ſo far diminiſhed, as to render them ineffectual for exciting the ſenſation of colours; and they are therefore called inefficacious rays, in contradiſtinction to thoſe which enter the drop near S N, and which, having the ſame point F of reflection, are not ſcattered like the others, but emerge together at G, ſo as to conſtitute a beam G R of the ſame denſity with the incident beam S N, and therefore capable of exhibiting a vivid appearance of colours, and for this reaſon are called efficacious rays.

Phænomena of the RAINBOW. — The firſt is, that each is variegated with all the priſmatic colours, This is a neceſſary conſequence of the different refrangibility of the rays refracted and reflected in drops of falling rain. Let A (plate CVIII. *fig.* 9.) be ſuch a drop, S N a ray entering in at N, which is refracted to F, from whence refracted to G, where, as it emerges, it is refracted into all the ſeveral ſorts of rays of which it is compoſed, viz. G R, the leaſt refrangible or red-making ray, G O the orange, G Y the yellow, G G the green, G B the blue, G I the indigo, and G V the violet, or moſt refrangible ray.

The truth of this may be eaſily proved by experiment, by ſuſpending a glaſs globe filled with water in the ſunſhine, and viewing it in ſuch a poſition, that the rays S N will fall upon it, and emerge to the eye at A, under the ſeveral angles from S F R to S F V; which may be eaſily effected by letting the globe deſcend from A to G, by a ſtring going over a pulley.

Hence, the ſecond phænomenon, viz. the circular form, is accounted for, and, alſo, the third, which is the breadth of the bow; for that will be equal to the angle A R G = R G V = 1° 45′, where the ray as here emerges after one reflection. Theſe particulars are repreſented more completely in *fig.* 10. where B G D is the red circumference formed by the rotation of the ray A G, that can firſt come to the eye at A; and C *g* F is the violet arch formed by the leaſt refrangible ray *g* A; after which the rays are all refracted below the eye. And thus, by the intermediate rays and colours, the whole interior bow is produced.

The fourth phænomenon is the appearance of two bows. This follows from hence, that after an efficacious ray of light S N, entering a drop of rain, has been twice reflected on the fartheſt ſide at F and H, it will emerge refracted into all its ſimple or conſtituent rays at G, upon the upper ſide of the drop, ſo as to make with the incident ray the angle G Y N, or S Y A, = 54° 10′, if that ray be the violet ſort, or moſt refrangible; but if it be of the red or leaſt refrangible ſort, then the ſaid angle is but 50° 58′ = S *y* A.

Therefore, all thoſe drops which are ſo ſituated around the eye, that their moſt refrangible rays ſhall fall upon it, muſt with thoſe rays make an angle with the line A P paſſing through the eye parallel to the ſun's rays, viz. the angle G A P, equal to the angle S Y A, or G A P = 54° 10′. Theſe rays, therefore, will every-where exhibit a violet colour in the arch P G L. For the ſame reaſon, thoſe drops whoſe leaſt refrangible rays fall upon the eye at A, make the angle *g* A P = 50° 58′; and ſo the ray A *g*, revolving about the axis A Q, will deſcribe the circular arch M *g* K, which will exhibit the deepeſt red; and all the drops between G and *g* will paint the ſeveral other coloured peripheries, all which together will complete the exterior bow.

The fifth phænomenon is the greater breadth of the exterior bow. Thus, if from 54° 10′ we ſubduct 50° 58′, we ſhall have 3° 12′ = G*g* = the width of the outer bow; which, therefore, is almoſt twice as wide as the interior bow.

The ſixth phænomenon is the diſtance between the two bows, which is thus determined: from the angle which the leaſt refrangible ray in the upper bow makes with the axis A P, viz. 50° 58′, ſubtract the angle 42° 02′, which the moſt refrangible rays make therewith in the lower bow, and the remainder 8° 56′ = *g* A F is the arch of diſtance between the bows.

The ſeventh phænomenon is the inverſe order of the colours in the two bows. This follows from the contrary parts of the drop on which the ray is incident, and from whence it emerges and is refracted. Thus, becauſe the rays S N enter the upper part of the drop, and emerge from the lower, it is evident the rays refracted in this caſe (viz. in the interior bow) will have a ſituation quite the reverſe of thoſe which enter on the lower part of the drop, and are refracted from the upper, as in the exterior bow, whoſe colours are violet, indigo, blue, green, yellow, orange, and red; whilſt thoſe of the other are red, orange, yellow, green, blue, indigo, and violet; counting from the upper parts downwards in both.

The eighth phænomenon is the faintneſs of the exterior bow, in compariſon of the interior one. This is the conſequence of the rays being twice reflected within the drops, which form the outer bow. They who make the experiment in a dark chamber, may wonder when they obſerve how large a part of the beam (that enters the globule at N) goes out at F, that there ſhould be enough in the remaining part F G to exhibit the colours ſo ſtrong and vivid in the firſt bow as they appear; but then conſidering how much of this reſidual ray is refracted at G, it is rather a wonder how the very ſmall part reflected to H, ſhould there, when refracted, be in quantity ſufficient to excite any diſtinct ideas of colours at all.

The ninth phænomenon is, that ſometimes more than two bows appear; as in a very black cloud we have obſerved four, and a faint appearance of a fifth: But this happens rarely. Now, theſe ſpurious bows, as we may call them, cannot be formed in the manner as the two principal bows are, that is, by refraction after a third, fourth, fifth, &c. refraction; for the beam is by much too weak to exhibit colours by reſtraction, even after the third reflection only, much leſs would it after a fourth or fifth. Beſides, though after a third and fourth reflection of the rays they ſhould be ſuppoſed capable of ſhewing their colours, yet the bows made thereby would not appear at the ſame time with the other two, nor in the ſame part of the heavens, but in the rain between us and the ſun, and muſt be viewed by the ſpectator's face turned towards the ſun, and not from it, as in the other caſe.

The tenth phænomenon is the appearance of the bows in that part of the heavens oppoſite to the ſun. This neceſſarily happens from the incident and emergent ray being both on one ſide of the drop; for it is evident, that in order to ſee the colours, we muſt look to that part againſt which the ſun ſhines.

The eleventh phænomenon is, that they never appear but when and where it rains. This is becauſe rain affords a ſufficient plenty of drops, or aqueous ſpherules, proper to reflect and refract the light fit for this purpoſe, which cannot be done without a requiſite ſize, figure, and diſpoſition of the particles, which the vapour of the cloud does not admit, and therefore clouds alone exhibit no ſuch appearance.

The twelfth phænomenon is the dimenſion of the bows. This is determined eaſily, for continuing the axis A P to Q the center of the bows, we have the ſemi-diameter of each bow in the angle Q A *g*, or Q A G; the double of which gives the angles which the whole diameters of the bows ſubtend, and are therefore the meaſure of their magnitude.

The thirteenth phænomenon is, the altitude of the bow above the horizon, or ſurface of the earth. This is equal to the angle G A T, which may be taken by a quadrant, or it may be known for any time by having given the ſun's altitude, which is equal to the angle T A Q; which therefore ſubducted from the conſtant angles Q A F, or Q A Y, will always leave the angle of the apparent height of the bow.

Lunar RAINBOW.—The moon ſometimes alſo exhibits the phænomenon of an iris, by the refraction of her rays in drops of rain in the night-time.

Ariſtotle ſays, he was the firſt that ever obſerved it, and adds that it is never viſible, but at the time of full moon.

The lunar iris has all the colours of the ſolar, only fainter. See Phil. Tranſ. N°. 331.

Marine RAINBOW, the ſea-bow, is a phænomenon ſometimes obſerved in a much agitated ſea, when the wind, ſweeping part of the tops of the waves, carries them aloft; ſo that the rays of the ſun are refracted, &c. as in a common ſhower.

F. Bourzes in Phil. Tranſ. obſerves, that there are ſcarce above two colours diſtinguiſhable, a dark yellow on the ſide next the ſun, and a pale green on the oppoſite ſide. But there are ſometimes twenty or thirty of them ſeen together. They appear at noon-day, and in a poſition oppoſite to that of the common bow, the concave ſide being turned upwards.

There is a kind of white colourleſs rainbow which Mentzelius and others ſaw at noon-day. Mr. Marriote in his fourth Eſſaie de Phyſique ſays, they are formed in miſts, as the others are in ſhowers; having obſerved ſeveral of them both after ſun-riſing and in the night.

The want of colours in theſe is owing to the exceeding tenuity of the veſicles of the vapour, which being only little watery pellicles bloated with air, the rays of light undergo but little refraction in paſſing out of air into them. Hence, the rays are reflected compounded, as they come.

Rohault mentions coloured rainbows on the graſs formed in the morning dew.

RAISER, in building, a board ſet on edge under the fore ſide of a ſtep, ſtair, &c.

RAISING-PIECES, or REASON-PIECES, in architecture, are pieces that lie under the beams, and over the poſts or puncheons.

RAISING, in navigation, the heightening any diſtant object at ſea, by approaching it, and levelling the intermediate ſpace, the convexity of which intercepts the view. See the articles EARTH and HORIZON.

RAISING *a Purchaſe*, amongſt ſailors, the diſpoſition of the machines, and component parts, in the proper order, to aſſiſt the motion of each other, and co-operate to produce the effect required.

RAISINS, grapes prepared by ſuffering them to remain on the vine till they are perfectly ripe, and then drying them in the ſun, or by the heat of an oven. The difference between raiſins dried in the ſun, and thoſe dried in ovens, is very obvious; the former are ſweet and pleaſant, but the latter have a latent acidity with the ſweetneſs that renders them much leſs agreeable.

The common way of drying grapes for raiſins, is to tie two or three bunches of them together while yet on the vine, and dip them into a hot lixivium of wood-aſhes, with a little of the oil of olives in it. This diſpoſes them to ſhrink and wrinkle, and after this they are left on the vine three or four days ſeparated on ſticks in an horizontal ſituation, and then dried in the ſun at leiſure, after being cut from the tree. The fineſt and beſt raiſins are thoſe called in ſome places Damaſcus and Jube raiſins; which are diſtinguiſhed from the others by their ſize and figures: theſe are flat and wrinkled on the ſurface, ſoft and juicy within, and near an inch long, and when freſh and growing on the bunch, are of the ſize and ſhape of a large olive.

The raiſins of the ſun, and jar-raiſins, are all dried by the heat of the ſun, and theſe are the ſorts uſed in medicine. However, all the kinds have much the ſame virtues; they are all nutritive and balſamic: they are allowed to be attenuant, are ſaid to be good in nephritic complaints, and are an ingredient in pectoral decoctions, in which caſes, as alſo in all others where aſtringency is not required of them, they ſhould have the ſtones carefully taken out.

RAITING, or RATING, the laying of flax, hemp, timber, &c. when green, in a pond or running water, to ſeaſon, and prepare it for future uſes.

RAKE *of a Ship*, the projection of the ſtem and ſtern beyond the fore-moſt and aftmoſt ends of the keel. Thus, if a plumb-line were ſuſpended over the ſtern, till it reaches as low as the keel, then would the diſtance between the after end of the keel and the plummet be the rake.

The diagonal line reaching up from the keel to the top of the ſtern, comprehending her length in different heights, is alſo termed the rake: upon this the beauty of a ſhip conſiderably depends.

RAKING *fore and aft*, in the ſea language, the act of cannonading a ſhip through either of the ends, by which the ſhot rake the whole length of her decks, and generally produce a great ſlaughter of the crew. This is the ſame operation with what is termed enfilade in the attack of defence or fortified places.

RAKING *of an horſe*, is drawing the ordure with the hand out of the fundament, when he is coſtive, and cannot dung: in doing which the hand ſhould be anointed with butter or ſallad oil.

RAKING-TABLE, or RAKED-TABLE, among architects, is a member hollowed in the ſquare of a pedeſtal, &c.

RALLYING, in war, re-aſſembling or calling together troops broken and put to flight.

RAM, in zoology, the male of the ſheep kind. See the article SHEEP.

RAM, in aſtronomy, the ſame with aries. See the article ARIES.

Battering RAM, in antiquity, a military engine uſed to batter and beat down the walls of places beſieged. See BATTERING-RAM.

RAMADAN, a ſolemn ſeaſon of faſting among the Mahometans, kept in the ninth month of the Arabic year. This faſt conſiſts in abſtaining from meat and drink, and from lying with their wives each day, from the riſing of the ſun till the ſtars appear; and is of ſuch ſtrict obligation, that none is excuſed from it; for the ſick, and all others who cannot obſerve it in this month, are obliged to faſt another entire month inſtead of it. So ſuperſtitious are the Mahometans in the obſervance of this lent, that they dare not waſh their mouths or even ſwallow their ſpittle. The men are, indeed, allowed to bathe themſelves, on condition they do not plunge the head under water, leſt ſome drops enter by the mouth or ears, &c. but as for the women, they are ſtrictly forbid bathing, for fear of taking in water at the pudendum. However, they frequently feaſt all night. The Mahometans call this month holy, and believe, that as long as it laſts, the gates of paradiſe are open, and thoſe of hell ſhut.

RAMAGE, the boughs or branches of trees.

RAMIFICATION, the production of boughs or branches, or of figures reſembling branches.

RAMMER, an inſtrument uſed for driving down ſtones or piles into the ground; or for beating the earth, in order to render it more ſolid for a foundation.

RAMMER *of a Gun*, the gun-ſtick; a rod uſed in charging of a gun, to drive home the powder, as alſo the ſhot and wad, which keeps the ſhot from rolling out. The rammer of a great gun is uſed for the ſame purpoſe. It has a round piece of wood at one end, and the other is uſually rolled in a piece of ſheep-ſkin, fitted to the bore of the piece, and is uſed to clear her after ſhe has been diſcharged, which is called ſpunging the piece.

RAMPANT, in heraldry, a term applied to a lion, leopard, or other beaſt that ſtands on his hind legs, and rears up his fore feet in the poſture of climbing, ſhewing only half his face, as one eye, &c. It is different from ſaliant, in which the beaſt ſeems ſpringing forward as if making a ſally.

RAMPART, in fortification, is an elevation of earth round a place capable of reſiſting the cannon of an enemy; and formed into baſtions, curtains, &c.

A rampart ought to be ſloped on both ſides, and to be broad enough to allow room for the marching of waggons and cannon, beſide that allowed for the parapet which is raiſed on it; its thickneſs is generally about ten or twelve fathom, and its height not above three, which is ſufficient to cover the houſes from the battery of the cannon. The rampart is encompaſſed with a ditch, and is ſometimes lined or fortified on the inſide, otherwiſe it has a berme.

Upon the rampart ſoldiers continually keep guard, and pieces of artillery are planted there for the defence of the place.

RAMPART, in civil architecture, is uſed for the ſpace left between the wall of a city, and the next houſes.

RAMPION, *Rapuntium*, in botany, a genus of plants, the flower of which conſiſts of one leaf, which is of an anomalous figure, hollowed like a pipe, and furrowed or channelled; divided, as it were, into many parts, in the ſhape of a tongue, defended by a vagina or covering, which infolds the pointal: when the flowers decay, the flower-cup turns to a fruit divided into three cells, full of ſmall ſeeds, which adhere to a placenta, which is divided into three parts.

The crimſon rapuntium is greatly prized by the curious, for the beauty of its rich crimſon flowers, which exceed all the flowers I have yet ſeen, in the deepneſs of its colour: and theſe commonly, when their roots are ſtrong, produce large ſpikes of theſe flowers, which continue a long time in beauty, and make a moſt magnificent ſhew amongſt other flowers. The time of their flowering is commonly in July and Auguſt; and if the autumn prove very favourable, they will ſometimes produce good ſeeds in England. Theſe plants are natives of Virginia and Carolina, where they grow by the ſides of rivulets, and make a moſt beautiful appearance; from whence the ſeeds are often ſent into England. Theſe ſeeds commonly arrive here in the ſpring; at which time they ſhould be ſown in pots filled with light earth, and but juſt covered over; for, if the ſeeds are buried deep, they will not grow. Theſe pots ſhould be placed under a frame, to defend them from cold, until the ſeaſon is a little advanced; but they ſhould not be placed on an hot-bed, which will alſo deſtroy the ſeeds.

When the weather is warm, towards the middle of April, theſe pots ſhould be placed in the open air, in a ſituation where they may have the morning ſun till twelve o'clock, obſerving to water them conſtantly in dry weather; and, when the plants are come up, and are grown pretty ſtrong, they ſhould be tranſplanted each into a ſmall pot filled with freſh light earth, and placed in the ſame ſituation, obſerving to water them in dry weather; and, in winter, they ſhould be placed under an hot-bed-frame, where they may be ſheltered from ſevere froſts; but, in mild weather, they ſhould be as much expoſed to the open air as poſſible.

The March following theſe plants ſhould be put into larger pots filled with the ſame freſh earth, and placed, as before, to the morning ſun; obſerving to water them in dry weather, which will cauſe them to flower ſtrong the autumn following.

Theſe plants are alſo propagated by parting of their roots: the beſt ſeaſon for which is, either ſoon after they are paſt flower, or in March; obſerving to water and manage them, as hath been directed for the ſeedling plants, both in winter and ſummer. *Miller's Gard. Dict.*

RANCID denotes a fatty ſubſtance that is become rank or muſty; or has contracted an ill ſmell by being kept cloſe.

RANDOM SHOT, in gunnery, is a ſhot made when the muzzle of a gun is raiſed above the horizontal line, and is not deſigned to ſhoot directly, or point blank.

The utmoſt random of any piece is about ten times as far as the bullet will go point blank. The bullet will go fartheſt when the piece is mounted to about 45° above the level range. See GUNNERY.

RANGE *of the Cable*, amongſt ſailors, a ſufficient length of it drawn upon deck before the anchor is caſt off, to let it ſink into the ground without being interrupted by the cable; accordingly the length of this range ought to be equal to the depth of the water where the anchor is to be ſunk to ride the ſhip.

RANGE, in gunnery, the path of a bullet, or the line it deſcribes from the mouth of the piece to the point where it lodges. If the piece lie in a line parallel to the horizon, it is called the right or level range: if it

be mounted to 45°, it is ſaid to have the utmoſt range: all others between 00 and 45° are called the intermediate ranges.

RANGER, a ſworn officer of a foreſt, appointed by the king's letters-patent, whoſe buſineſs is to walk thro' his charge, to drive back the deer out of the purlieus, &c. and to preſent all treſpaſſes within his juriſdiction at the next foreſt-court.

RANGING, in war, diſpoſing the troops in the order proper for engagement, or for marching.

RANGING, in building, ſignifies running ſtraight, when the ſides of a work do not break into angles.

RANK, the order or place allotted a perſon ſuitable to his quality or merit.

RANSOM, a ſum of money paid for the redemption of a ſlave, or for the liberty of a priſoner of war. In our law-books ranſom is alſo uſed for a ſum paid for the pardon of ſome great offence, and to obtain the offender's liberty.

RANT, in the drama, an extravagant, unnatural, and improbable flight of paſſion.

RANULA, or RANA, in medicine, a tumour under the tongue, which like a ligature hinders a child from ſpeaking or ſucking.

The matter contained in theſe tumours is various, it being ſometimes a tenacious and mucous lymph, ſometimes a thick and purulent matter, and ſometimes of a hard and ſtony conſiſtence.

The ſafeſt method of cure, according to Heiſter, is to turn the tongue upwards, and to make a tranſverſe inciſion through the tumour, in order to diſcharge the included matter; after which you may deterge or deſtroy the remaining tunic with honey of roſes ſharpened with ſpirits of vitriol, and then the cure may be eaſily completed with a mixture of oil and ſugar. Sometimes the tubercle breaks of itſelf, and then you muſt deterge and heal the ulcer as before.

RANUNCULUS, in botany, a genus of plants, the flower of which conſiſts of ſeveral leaves, which are placed in a circular order, and expanded in form of a roſe; having, for the moſt part, a many leaved empalement or flower-cup; out of the middle of the flower riſes the pointal, which afterwards becomes a fruit, either round, cylindrical, or ſpiked; to the axis of which as a placenta, adhere many ſeeds, for the moſt part naked.

There are a great variety of ſpecies of ranunculus; but that called the Perſian ranunculus being univerſally admired, we ſhall only give the method of cultivating that beautiful flower.

The beds in which the Perſian ranunculus roots are planted, ſhould be made with freſh light ſandy earth, at leaſt three feet deep; the beſt ſoil for them may be compoſed in this manner, viz. take a quantity of freſh earth from a rich upland paſture, about ſix inches deep, together with the green ſward: this ſhould be laid in an heap to rot, for twelve months before it is mixed, obſerving to turn it over very often, to ſweeten it, and break the clods: to this you ſhould add a fourth part of very rotten neat's dung, and a proportionable quantity of ſea or drift ſand, according as the earth is lighter or ſtiffer; if it be light, and inclining to a ſand, there ſhould be no ſand added; but if it be an hazel loam, one load of ſand will be ſufficient for eight loads of earth: but if the earth is ſtrong and heavy, the ſand ſhould be added in a greater proportion: this ſhould be mixed ſix or eight months before it is uſed; and you ſhould often turn it over, in order to unite their parts well together, before it is put into the beds.

The depth which this ſhould be laid in the beds, muſt be about three feet; this ſhould be below the ſurface, in proportion to the dryneſs or moiſture of the place where they are ſituated; which, in dry ground, ſhould be two feet eight inches below the ſurface, and the beds raiſed four inches above; but in a moiſt place they ſhould be two feet four inches below, and eight above the ground; and, in this caſe, it will be very proper to lay ſome rubbiſh and ſtones at the bottom of each bed, to drain off the moiſture; and if, upon this, at the bottom of the beds, ſome very rotten neat's dung is laid two or three inches thick, the roots will reach this in the ſpring, and the flowers will be the fairer. This earth I would by no means adviſe to be ſkreened very fine: only, in turning it over each time, you ſhould be careful to break the clods, and throw out all large ſtones, which will be ſufficient; for if it is made very fine, when the great rains in winter come on, it will cauſe the earth to bind into one ſolid lump, whereby the moiſture will be detained, and the roots, not being able to extend their tender fibres, will rot.

The beds, being thus prepared, ſhould lie a fortnight to ſettle, before the roots are planted, that there may be no danger of the earth ſettling unequally after they are planted; which would prejudice the roots, by having hollow places in ſome parts of the bed, to which the water would run and lodge, and ſo rot the roots in ſuch places. Then having levelled the earth, laying the ſurface a little rounding, you ſhould mark out the rows by a line, at about ſix inches diſtance each way, ſo that roots may be planted every way in ſtraight lines; then you ſhould open the earth with your fingers at each croſs, where the roots are to be planted, about two inches deep; placing the roots exactly in the middle, with their crowns upright; then with the head of a rake, you ſhould draw the earth upon the ſurface of the bed level, whereby the top of the roots will be about an inch covered with earth, which will be ſufficient at firſt. This work ſhould be done in dry weather, becauſe the earth will then work better than if it were wet; but the ſooner after planting there happens to be rain, the better it will be for the roots, for if it ſhould prove dry weather long after, and the earth of the beds be very dry, the roots will be ſubject to mould and decay; therefore, in ſuch a caſe, it will be proper to give a little water to the beds, if there ſhould no rain happen in a fortnight's time, which is very rare at that ſeaſon of the year; ſo that they will ſeldom be in danger of ſuffering that way.

When the roots are thus planted, there will no more be required until towards the end of November; by which time they will begin to heave the ground, and their beds appear; when you ſhould lay a little of the ſame freſh earth, of which the beds were compoſed, about half an inch thick all over the beds, which will greatly defend the crown of the root from froſt: and when you perceive the buds to break through this ſecond covering, if it ſhould prove very hard froſt, it will be very proper to arch the beds over with hoops, and cover them with mats, eſpecially in the ſpring, when the flower buds will begin to appear; for if they are expoſed to too much froſt, or blighting winds, at that ſeaſon, their flowers ſeldom open fairly, and many times their roots are deſtroyed: but this happens more frequently to the Perſian kinds, which are tenderer, than to thoſe ſorts which are pretty hardy; for which reaſon they are commonly planted in open borders, intermixed with other flowers, though in very hard winters theſe are apt to ſuffer, where care is not taken to guard off the froſt.

In the beginning of March the flower ſtems will begin to riſe, at which time you ſhould carefully clear the beds from weeds, and ſtir the earth with your fingers beween the roots, being very careful not to injure them; this will not only make the beds appear handſome, but alſo greatly ſtrengthen their flowers. When the flowers are paſt, and the leaves are withered, you ſhould take up the roots, and carefully clear them from the earth; then ſpread them upon a mat to dry, in a ſhady place; after which they may be put up in bags or boxes, in a dry room, until the October following, which is the ſeaſon for planting them again.

RANULARES, or RANINE VEINS, in anatomy, two veins under the apex of the tongue, which ariſe from the internal jugular, and run on either ſide the linea mediana. See TONGUE.

RAPACIOUS ANIMALS are ſuch as live upon prey.

RAPE, in law, the having carnal knowledge of a woman by force and againſt her will.

The civilians make another kind of rape, called rape of ſubornation or ſeduction; which is ſeducing a maid either

either to uncleanneſs or marriage, and that by gentle means, provided there be a conſiderable diſparity in the age and circumſtances of the parties.

RAPE *of the Foreſt*, a treſpaſs committed in a foreſt by violence.

RAPE is alſo a name given to a diviſion of a county, and ſometimes means the ſame as a hundred, and at other times ſignifies a diviſion conſiſting of ſeveral hundreds; thus Suſſex is divided into ſix rapes, every one of which, beſides its hundreds, has a caſtle, a river, and foreſt belonging to it. The like parts in other counties are called tithings, laths, or wapentakes.

RAPE alſo ſignifies the ſtalks of the cluſters of grapes when dried and freed from the fruit. This is uſed in making vinegar.

RAPE. See the article NAVEW.

RAPHANUS, the radiſh. See RADISH.

RAPIER formerly ſignified a long, old faſhioned broad ſword, ſuch as thoſe worn by the common ſoldiers: but it now denotes a ſmall ſword, ſuch as contradiſtinguiſhed from a back-ſword.

RAPINE, in law, taking away another's goods, &c. openly and by violence.

RAPTURE, RAPTURA, an extaſy or tranſport of mind. See EXTASY, ENTHUSIASM, &c.

RAREFACTION, *rarefactio*, in phyſics, the act whereby a body is rendered rare; that is, brought to poſſeſs more room, or appear under a larger bulk without acceſſion of any new matter.

Rarefaction is moſt properly reſtrained to that expanſion of a maſs into a larger bulk, which is effected by heat. All expanſion from other cauſes they call dilatation.

It is by rarefaction that gunpowder has its effect, and to the ſame principle alſo we owe our æolipiles, thermometers, &c. The degree to which the air is rarifiable, exceeds all imagination; ſuch is the rarefaction of common air from its own principle of elaſticity, and without any previous condenſation, that Mr. Boyle found it to dilate itſelf ſo as to take up 13679 times its former ſpace; and when compreſſed, the ſame author found its greateſt ſpace when moſt rarified, to its leaſt when moſt condenſed, as 550000 to 1.

Such an immenſe rarefaction, Sir Iſaac Newton ſhews is inconceivable on any other principle than that of a repelling force inherent in the air, whereby its particles mutually fly from one another. This repelling force, he obſerves, is much more conſiderable in air than in other bodies, as being generated from the moſt fixed bodies, and that with much difficulty, and ſcarce without fermentation; thoſe principles being always found to fly each other with the moſt force, which, when in contact, cohere the moſt firmly. M. Mariotte eſtabliſhed this as a principle, from experiments, that the different rarefactions or condenſations of the air follow the proportion of the weights wherewith it is preſſed. Hence, ſuppoſing the mercury in the level of the ſea ſuſpended to 28 inches, which is the weight of the whole atmoſphere; and that 60 feet height of air are equivalent to a line or $\frac{1}{12}$ of an inch of mercury, ſo that the barometer at the height of 60 feet from the ſea, would fall a line; it is eaſy finding what height of air would be equal to a ſecond, or any other line of mercury; for, as 28 inches of mercury $\frac{1}{12}$ are to 28 inches, ſo is the height of 60 feet of air to a fourth term, which is the height of air correſponding to a ſecond line of mercury. And after the ſame manner may the height of air correſponding to each line be found, which will make a geometrical progreſſion, the ſum whereof will be the whole height of the atmoſphere, and of conſequence a certain part of that ſum will be the height of a mountain, at whoſe top the barometer ſhall have ſunk a certain quantity. See BAROMETER.

Meſſ. Caſſini and Maraldi, upon meaſuring the heights of ſeveral mountains, found that this progreſſion of M. Mariotte was defective; that it always gave the height of the mountains, and conſequently the rarefactions leſs, than they really were; and from ſome farther experiments M. Amontons found, that the principles will only hold in the mean rarefactions, not the extremes.

The open air, in which we breathe, ſays Sir Iſaac Newton, is 8 or 900 times lighter than water, and by conſequence 8 or 900 times rarer. And ſince the air is compreſſed by the weight of the incumbent atmoſphere, and the denſity of the air is proportionable to the compreſſing force, it follows by computation, that at the height of about ſeven Engliſh miles from the earth, the air is four times rarer than at the ſurface of the earth; and at the height of 14 miles, it is 16 times rarer than at the ſurface of the earth; and at the height of 21, 28, or 35 miles, it is reſpectively 64, 256, or 1024 times rarer, or thereabouts; and at the height of 70, 140, and 210 miles, it is about 1000000, 1000000000000, or 1000000000000000000, &c.

Mr. Cotes has found, from experiments made with a thermometer, that linſeed-oil is rarified in the proportion of 40 to 39 in the heat of the human body; in that of 15 to 14, in that degree of heat wherein water is made to boil; in the proportion of 15 to 13, in that degree of heat wherein melted tin begins to harden; and, finally, in the proportion of 23 to 20, in that degree wherein melted tin arrives at a perfect ſolidity. The ſame author diſcovered, that the rareſaction of the air in the ſame degree of heat is ten times greater than that of the linſeed oil; and the rarefaction of the oil, about fifteen times greater than that of the ſpirit of wine.

RASANT, or RAZANT, in fortification. Raſant-flank, or line, is that part of the curtain or flank whence the ſhot exploded raſe, or glance, along the ſurface of the oppoſite baſtion.

RASH, in medicine, a eruption upon the ſkin, thrown out in fevers or ſurfeits.

RASPBERRY, a ſpecies of bramble growing naturally wild in the woods in the northern parts of England, but is cultivated in gardens for its fruit, which ſupplies the table at the ſeaſon when they are ripe.

There are two or three varieties of this, one with a red, and the other a white fruit, and the third generally produces two crops of fruit annually; the firſt ripens in July, and the ſecond in October, but thoſe of the latter ſeaſon have ſeldom much flavour.

The raſpberry is generally propagated by ſuckers, though ſuch plants are to be preferred as are raiſed by layers, becauſe they will be better rooted, and not ſo liable to ſend out ſuckers as the other, which generally produce ſuch quantities of ſuckers from their roots, as to fill the ground in a year or two; and where they are not carefully taken off, or thinned, will cauſe the fruit to be ſmall, and in leſs quantities, eſpecially when the plants are placed near each other, which is too often the caſe, for there are few perſons who allow theſe plants ſufficient room.

In preparing theſe plants, their fibres ſhould be ſhortened; but the buds, which are placed at a ſhort diſtance from the ſtem of the plant, muſt not be cut off, becauſe thoſe produce the new ſhoots the following ſummer. Theſe plants ſhould be planted about two feet aſunder in the rows, and four or five feet diſtance row from row; for if they are planted too cloſe, their fruit is never ſo fair, nor will ripen ſo kindly, as when they have room for the air to paſs between the rows. The ſoil in which they thrive beſt, is a freſh ſtrong loam, for in warm light ground they do not produce ſo great plenty of fruit, for they naturally grow in cold land, and in ſhade; therefore when they are planted in a warm ſituation and a light ſoil, they do not ſucceed.

The ſeaſon for dreſſing them is in October, at which time all the old wood that produced fruit the preceding ſummer, ſhould be cut down below the ſurface of the ground, and the young ſhoots of the ſame year muſt be ſhortened to about two feet in length; then the ſpaces between the rows ſhould be well dug, to encourage their roots; and if you bury a very little rotten dung therein, it will make them ſhoot vigorouſly the following ſummer, and their fruit will be much fairer. During the ſummer ſeaſon, they ſhould be kept clear from weeds, which with the before-mentioned culture, is all the management they will require; but it is proper to make new plantations once in three or four years, becauſe when the plants are ſuffered to remain long, they will produce few and ſmall fruit.

RAT, in zoology, the Engliſh name of ſeveral ſpecies of the mus-kind; as the common rat, the ground-rat, and the water-rat.

The common rat is a quadruped too well known to need much deſcription. It is of a browniſh-grey colour, with a long and almoſt naked tail. It greatly reſembles the common mouſe in form, but it is at leaſt five times as large: the tail is divided into more than an hundred and fifty annular joints.

The ground-rat is nearly of the ſize of the common rat, only that its tail is much ſhorter, as well as more hairy.

The water-rat is conſiderably larger than the common kind: its tail is all the way of the ſame thickneſs, and is abrupt at the end: its legs are ſhorter than thoſe of the common rat, but its feet are longer, and the toes connected by membranes.

RAT-TAILS, or ARRESTS, in the manege, ſignify hard callous ſwellings upon the hinder legs under the hough, running along the ſinew.

A horſe is called rat-tail, when he has no hair upon his tail.

RATAFIA, a fine ſpirituous liquor, prepared from the kernels, &c. of ſeveral kinds of fruit, particularly of cherries and apricots.

Ratafia of cherries is prepared by bruiſing the cherries, and putting them into a veſſel wherein brandy has been long kept; then adding to them the kernels of cherries, with ſtrawberries, ſugar, cinnamon, white pepper, nutmegs, cloves; and to twenty pound of cherries, ten quarts of brandy. The veſſel is left open ten or twelve days, and then ſtopped cloſe for two months before it be tapped. Ratafia of apricots is prepared two ways, viz. either by boiling the apricots in white wine, adding to the liquor an equal quantity of brandy with ſugar, cinnamon, mace, and the kernels of apricots; infuſing the whole for eight or ten days; then ſtraining the liquor, and putting it up for uſe: or elſe by infuſing the apricots cut in pieces in brandy, for a day or two, paſſing it through a ſtraining bag, and then putting in the uſual ingredients.

RATCH, or RASH, in clock-work, a ſort of wheel having twelve fangs, which ſerve to lift up the detents every hour, and make the clock ſtrike. See the article CLOCK.

RATCHETS, in a watch, are the ſmall teeth at the bottom of the fuſy, or barrel, which ſtops it in winding up.

RATE, a ſtandard or proportion, by which either the quantity or value of a thing is adjuſted.

RATE, in the royal navy, the degree, or order, into which veſſels of war are uſually claſſed: of theſe there are ſix, beſides ſloops, armed ſhips, bomb-veſſels, fire-ſhips, &c. The firſt comprehends the ſhips of 110 and 101 pieces of cannon: the ſecond, thoſe which carry 90: the third, thoſe from 84 to 64: the fourth, thoſe of 60 and 50: the fifth, thoſe of 40, 36, and 32; and laſtly, the ſixth, thoſe of 28, 24, and 20. All theſe are commanded by captains; thoſe of the ſloops, armed ſhips, &c. by an officer ſtiled the maſter and commander.

RATE-TYTHE, when ſheep or other cattle are kept in a pariſh for leſs time than a year, the owner muſt pay tythe for them, *pro rata*, according to the cuſtom of the place.

RATEEN, or RATTEN, in commerce, a thick woollen ſtuff, quilled, woven on a loom with four treddles, like ſerges, and other ſtuffs, that have the whale or quilling. There are ſome rateens dreſſed and prepared like cloths; others left ſimply in the hair, and others where the hair or knap is frized. Rateens are chiefly manufactured in France, Holland, and Italy, and are moſtly uſed in linings. The frize is a ſort of coarſe rateen, and the drugget is a rateen half linen, half woollen.

RATIFICATION, *Ratificatio*, an act approving of, and confirming ſomething done by another in our name.

RATIFICATION is alſo uſed for an act confirming ſomething we ourſelves have done in our name.

RATIO, REASON, in arithmetic and geometry, is that relation of homogeneous things which determines the quantity of one from the quantity of another, without the intervention of a third.

Two numbers, lines, or quantities, A and B, being propoſed, their relation one to another may be conſidered under one of theſe two heads:

1. How much A exceeds B, or B exceeds A; and this is found by taking A from B, or B from A, and is called arithmetic reaſon or ratio.

2. Or how many times, as parts of a time, A contains B, or B contains A; and this is called geometric reaſon or ratio; (or, as Euclid defines it, it is the mutual habitude, or reſpect, of two magnitudes of the ſame kind, according to quantity; that is, as to how often the one contains, or is contained, in the other) and is found by dividing A by B, or B by A; and here note that that quantity which is referred to another quantity, is called the antecedent of the ratio; and that to which the other is referred, is called the conſequent of the ratio; as, in the ratio of A to B, A is the antecedent, and B the conſequent.

3. Therefore any quantity, as antecedent, divided by any quantity as a conſequent, gives the ratio of that antecedent to the conſequent.

Thus the ratio of A to B is $\frac{A}{B}$, but the ratio of B to A is $\frac{B}{A}$; and, in numbers, the ratio of 12 to 4 is $\frac{12}{4}=3$, or triple; but the ratio of 4 to 12 is $\frac{4}{12}=\frac{1}{3}$, or ſubtriple.

4. And here note, that the quantities, thus compared, muſt be of the ſame kind; that is, ſuch, which, by multiplication, may be made to exceed one the other, or as theſe quantities are ſaid to have a ratio between them, which, being multiplied, may be made to exceed one another. Thus a line, how ſhort ſoever, may be multiplied, that is, produced ſo long as to exceed in length any given right line, and conſequently theſe may be compared together, and the ratio expreſſed; but as a line can never, by any multiplication whatever, be made to have breadth, that is, to be made equal to a ſuperficies, how ſmall ſoever; theſe can therefore never be compared together, and conſequently have no ratio or reſpect one to another, according to quantity; that is, as to how often the one contains, or is contained in the other. See PROPORTION.

RATIOCINATION, *Ratiocinatio*, the act of reaſoning. See the article REASONING.

RATION, or RATIAN, in the army, a portion of ammunition bread, drink, and forage, diſtributed to each ſoldier in the army, for his daily ſubſiſtence, &c. The horſe have rations of hay and oats when they cannot go out to forage. The rations of bread are regulated by weight. The ordinary ration of a foot ſoldier is a pound and a half of bread per day. The officers have ſeveral rations, according to their quality, and the number of attendants that they are obliged to keep. When the ration is augmented on occaſions of rejoicing, it is called a double ration. The ſhip's crews have alſo their rations or allowances of biſket, pulſe, and water, proportioned according to their ſtock.

RATIONAL, REASONABLE. See REASON.

RATIONAL is alſo applied to integral, fractional, and mixed numbers: thus we ſay rational fraction, rational integer, and rational mixed number, for the explanation and doctrine of which, ſee NUMBER and FRACTION.

RATIONAL is applied to the true horizon, in oppoſition to the ſenſible or apparent one. See HORIZON.

RATIONAL is alſo applied to quantity, ratio, &c. See QUANTITY, RATIO, &c.

RATIONALE, a ſolution, or account of the principles of ſome opinion, action, hypotheſis, phænomenon, or the like.

RATIONIS *Os*, in anatomy, a term ſometimes uſed for the os frontis. See the article FRONTIS *Os*.

RATTLE-SNAKE, in natural hiſtory, a very dreadful ſpecies of ſerpents, whoſe bite is fatal, if not timely remedied, and which is diſtinguiſhed from all other ſerpents by the rattle in its tail. This is compoſed of ſeveral ſcaly ſubſtances, and is ſaid to increaſe by the creature's age, every year adding one ſcale to it. It moves

moves over the rocks and mountains with prodigious ſwiftneſs; but is leſs nimble on even ground, than many other ſnakes.

It grows to four or five feet long, and ſometimes, tho' rarely, to more: one, of more than four feet long, having been diſſected, and accurately deſcribed by Dr. Tyſon, the account that gentleman gives of it may not be unacceptable to the reader: The body where largeſt, which was near the middle, meaſured ſix inches and an half round; its neck only three inches. Its head was flat, as that of the viper; and, as the jaws are very broad and protuberant, and the noſe ſharp, it ſomewhat reſembles the head of an arrow. At the end of the noſe are placed the noſtrils; and between theſe and the eyes there are two other holes, which may be miſtaken for ears; but they only go into a hollow of the bones of the ſkull, without any perforation into the brain. The viper has nothing of theſe holes. The eyes are round, and wholly reſemble thoſe of the viper. The whole body of the creature alſo greatly reſembles the viper, but for the ſingularity of the rattle; and over the eyes there are two large ſcales looking like eye-brows.

The ſcales which cover the head are very ſmall; thence they become gradually larger, as they reach towards the middle of the body, and from the middle to the tail they grow leſs and leſs again; and all, in ſhape, much reſemble the broad and flat ſeeds of the common garden parſnip. There is ſome variety in the colours of this creature, whether according to the difference of age or ſex, or from leſſer accidents. The moſt uſual colours are theſe: the ſcales are of a duſky greeniſh, like the feathers of the back of the green-finch, and are variegated with ſmall black ſpots in great numbers; there are alſo four large ones of the ſame colour.

The back is of a mixed colour, of a dead yellowiſh brown, variegated with blotches of black and yellow, and with a number of ſmall dots of the ſame colours; the larger blotches being laid in great regularity, and making a very beautiful teſſelated figure. The ſcales become darker, as they approach the tail, where they are almoſt black; and thoſe on the ridge of the back, all along, are raiſed into a ſort of ſharp prominence in their middle, like the ſcales of a crocodile: thoſe on the ſides are plain and flat. The belly is all along covered with oblong parallelogram ſcales laid tranſverſely; theſe are very bright and gloſſy, and yellow, ſpotted with black.

The head is ſmall, in proportion to the body, but the mouth is capable of opening to a prodigious width. The tongue is wholly like that of the viper, compoſed of two oblong portions, joined towards the baſes, but ſeparate as they approach the end. The teeth are of two kinds, the ſmaller ones deſigned for its eating with, the larger and longer for biting and poiſoning what it ſeizes. Theſe are only placed in the upper jaw; but all the teeth of the mouth are of the canine kind, as the creature, never chewing its prey, has no uſe for dentes molares, or grinders.

The poiſonous teeth are ſituated on the outſide of the jaw, in the anterior part of the mouth, not fixed in the ſockets of the jaws, as the others, but fixed to two bones. Theſe, in their natural ſtate, are not viſible, even when the creature's mouth is opened, unleſs it be with an intent to wound; for they lie back under a membranaceous covering, and the creature has a power of erecting and wounding with them at pleaſure, as the lion and cat kind can retract or thruſt out their claws. The teeth are crooked, and have a hollow at their bottom; and, at the point, a very plain and evident ſlit, looking like the nib of a writing-pen. The teeth are hollow all the way, from this ſlit to their bottom; and, on preſſing the gums in a dead rattle-ſnake, the poiſonous juice may be ſeen to aſcend, by degrees, up the teeth, and, at length, to be diſcharged out of the ſlit at the point. This makes it very plain in what manner the poiſon is conveyed into the fleſh, when the creature bites.

The rattle is affixed to the laſt vertebra of the tail, and is compoſed of a ſeries of ſmall bones; that next the tail is uſually of a bluiſh grey colour, the reſt of a pale brown. Theſe bones are hollow, very thin, hard and dry, and of a brittle texture, and very ſonorous. They are all of the ſame figure, repreſenting, in ſome degree, the os ſacrum in the human ſkeleton, and all are nearly of the ſame ſize. The laſt of theſe is ſeen to have a rigid extremity, in manner of a tail; and all the others have the ſame, though it is not diſtinguiſhable in them, as, in the joining, it runs under two others, and, by means of this ſtructure, they are all moveable with the ſmalleſt force, and the ſound is the more vigorous, as each of theſe tails ſtrikes on two of the hollow joints, when put into motion. The age of the creature is known by the number of joints of this rattle, which are found to be from one to twenty, or more. The uſe or this ſeems not to be to the creature itſelf, but to other animals, that they may be alarmed at the approach of ſo terrible an enemy, and get out of its way in time. Piſo and ſome others affirm, that this rattle, put up a man's fundament, is as fatal a thing as the creature's bite. The power of doing miſchief, which nature has allotted to this animal, ſeems not only by its bite; but, according to the joint accounts of almoſt all authors, it appears to have a power of deſtroying, even by a look.

The charming or faſcination of the rattle-ſnake, as this is uſually called, has exerciſed the wits of many naturaliſts in vain, and many have diſbelieved the fact. Sir Hans Sloane mitigates the matter, by ſuppoſing the creature firſt to ſeize or bite its prey, which it then ſuffers to eſcape, as far as the poiſon will let it, watching its death, that it may devour it without trouble: and that it is in this poiſoned ſtate that people have ſeen the ſquirrels, &c. dancing about before the rattle-ſnake, and dying convulſed; all which they have attributed to the power of charming in the eye of the ſnake, not conceiving that it was the effect of the creature's having before bit them. This, though a very plauſible account, yet, however, wants experience to confirm it, and the general teſtimony of people, who have ſeen the facts, makes againſt it.

The ſame author gives us, however, from colonel Beverly, the whole proceſs of the charm. The colonel acquaints us, that ſome company he was with once ſaw a hare, about half grown, ſitting quietly in an orchard, and, ſtriking at her, ſhe only removed a few yards: when wondering at the cauſe, they ſaw a rattle-ſnake, at about ten feet diſtance, eyeing the hare as his deſtined prey.

The poor creature was, by this time, in agonies and convulſions, often getting up on her legs, as if intending to run away, but always immediately falling down again; and, growing worſe and worſe, ſoon loſt the uſe of its hinder legs, and, panting vehemently, fell on its ſide. In about half an hour more, the hare ſeemed to have done with all ſtruggles, and to be dead; on which the ſnake uncoiled itſelf, and moved gently towards it, but, the poor hare ſtarting again, he ſtopped; but, when all was again quiet, he moved up to it, and, raiſing his head, looked all over his prey, his colours looking at that inſtant more beautiful than before, and his eyes ſparkling. The hinder part of the hare had been towards the ſnake all this time, and it had periſhed without much looking at its enemy. The ſnake wetted the body all over with ſlaver; and then, with great difficulty, taking firſt the head into his month, ſwallowed that, and afterwards the whole body, ſucking it gently down, but not getting in the ſhoulders without much difficulty.

It is certain upon the whole, that there is much in this account to favour Sir Hans Sloane's opinion of the hare's having been bitten, though that was not ſeen, ſince the convulſions, and loſs of the uſe of the hinder legs, ſeem a very natural effect of poiſon; but we are aſſured by perſons who have been eye-witneſſes to the fact, that a bird, hopping about in all this agony and terror, has, on the frightening the rattle-ſnake away, flown off without any difficulty: ſo that the whole ſeems not yet underſtood.

RATTLE-SNAKE-ROOT, in botany, a plant with oblong, ſomewhat oval, pointed leaves; upright unbranched ſtalks; white flowers; and a variouſly bent and divaricated jointed root, about the thickneſs of the little finger, with a membranous margin running its whole length on each ſide, externally of a yellowiſh or pale browniſh colour, internally white. It is a native of Virginia, Penſylvania,

Penſylvania, and Maryland, and cultivated in ſome of our gardens.

Dr. Tennent gives his rattle-ſnake-root, or Virginian polygala, in the doſe of thirty-five grains in ſubſtance, or in three or four ounces of a ſtrong infuſion, or in a yet ſtronger, in a proportionably ſmaller doſe. The effects of this root being found very great, it was ſuppoſed that its place might poſſibly be ſupplied by this ſpecies of our own growth. It is very certain, that the place of growth may, in ſome plants, make a very great alteration in their virtues; and that the different ſpecies of the ſame genus may, in other inſtances, produce different effects in the human body, ſome ſpecies of plants agreeing in their external forms and generical characters, while they differ in their virtues and qualities.

There appeared on trial a conſiderable difference to the taſte between the American and the European polygala roots; that of Virginia being very aromatic, acrid, and bitter, and the European only ſlightly acrid, with a very feeble bitterneſs. Another thing that gave great ſuſpicion as to the parallel virtues of the roots of theſe two ſpecies was, that Geſner was found, in his account of the virtues of the European polygala, to call it a briſk cathartic; a quality which might render its uſe very improper in many of the diſeaſes in which Mr. Lemery and Juſſieu found the Virginian kind to prove a ſerviceable medicine. This laſt was found always very ſpeedily to allay fevers of the pleuritic kind, without increaſing in any great degree the diſcharges by ſtool.

The roots of the European polygala, being very ſmall and ſlender, gave alſo ſome trouble as to the procuring them in ſufficient quantity; and in hopes it might become a general medicine, it was determined to try the effects of the whole plant, root, leaf, and branch, in the diſeaſe in which the Virginian kind had been given with the greateſt ſucceſs, that is, in pleuriſies; and this was accordingly fairly tried.

The principal inſtances of their trials were two; the firſt to a woman of twenty-two years old, who had a violent fever, with a ſizy blood, and pain in the ſide. She was twice blooded, and had immediate, but not laſting relief from it, and was ordered the common ptiſans given on theſe occaſions. The malady increaſed, and the expectoration was but ſmall, and that of a thick yellow matter: a third bleeding finally was judged neceſſary, but was of no more ſervice than the others; and after this ſhe had the ſame ptiſan continued, but with the addition of a large quantity of the common European polygala, ſtalk, root, and leaf. This took place in two or three hours, the expectoration became vaſtly plentiful, and the matter thin and white, from being thick and yellow. The woman, in fine, was cured, and the medicine was not obſerved to occaſion any nauſea, nor did it prove, as ſuppoſed, a violent purge.

The ſecond inſtance was in a man of a ſtout robuſt habit, and of twenty-five years of age. He was violently attacked with a pleuriſy; he was bled ſeven times, and was brought into one of the hoſpitals delirious, and ſeemingly very near death: he was there blooded in the foot, which reſtored his ſenſes; and he took a large quantity of the decoction of the polygala, which cauſed him to expectorate in great abundance. The matter was firſt blackiſh, then reddiſh, and finally white, and the patient was perfectly cured. *Mem. Acad. Scienc. Par.* 1739.

Theſe are ſuch remarkable inſtances of the good effect of an herb to be had every-where in our own country, that they ſeemed very worthy to be recorded. The plant grows with us on dry grounds and heaths, and is about four inches long, not erect, but trailing upon the ground: the leaves are long and narrow, of a pale green, and the flowers are large and look beautiful: they ſtand in ſpikes, and are uſually blue; but very often white, and ſometimes red. The herb ſhould be pulled up root and all for drying.

RATTLINGS, in the ſea language, pieces of ſmall cord tied horizontally from ſhroud to ſhroud to form the ſteps, like thoſe of a ladder, by which the ſailors climb to the maſt-head, to perform the neceſſary buſineſs aloft. All the ſhrouds of a ſhip are rattled, except thoſe of the top-gallant-maſts; and in Dutch veſſels they are alſo furniſhed with rattlings.

RAVELIN, in fortification, was anciently a flat baſtion, placed in the middle of a curtain; but now a detached work compoſed only of two faces, which make a ſaliant angle, without any flanks, and raiſed before the curtain on the counterſcarp of the place. A ravelin is a triangular work, reſembling the point of a baſtion, with the flanks cut off.

RAVEN, in ornithology, a ſpecies of the corvus. See CORVUS.

RAVISHMENT, in law, denotes an unlawful ſeducing either of a woman, or an heir that is in ward: ſometimes it is alſo uſed in the ſame ſenſe as a rape.

RAY, in optics, a beam of light, emitted from a radiant, or luminous body. See LIGHT.

Rays are defined by Sir Iſaac Newton, to be the leaſt parts of light, whether ſucceſſive in the ſame line, or cotemporary in ſeveral lines. For that light conſiſts of parts of both kinds is evident, ſince one may ſtop what comes this moment in any point, and let paſs that which comes preſently after: now the leaſt light or part of light, which may be thus ſtopped, he calls a ray of light.

A ray or right line, drawn from the point of concourſe of the two optical axes, through the middle of the right line, which paſſes by the centers of the two pupils of the eyes, is by ſome called a common ray.

RAYONANT, or CROSS RAYONANT, in heraldry, one which has rays of glory behind it, darting out from the center to all the quarters of the eſcutcheon.

RE, in grammar, an inſeparable particle added to the beginning of words, to double, or otherwiſe modify, their meaning; as in *re-action*, *re-move*, *re-export*, &c.

RE-ACTION, in phyſiology, the reſiſtance made by all bodies to the action or impulſe of others, that endeavour to change its ſtate, whether of motion or reſt.

REACH, any portion of a river which runs upon a ſtraight line, comprehending the neareſt diſtance between two points.

READINGS, or *various* READINGS, *Variæ Lectiones*, in criticiſm, are the different manner of reading the texts of authors in antient manuſcripts, where a diverſity has ariſen from the corruption of time, or the ignorance of copyiſts. A great part of the buſineſs of critics lies in ſettling the readings, by confronting the various readings of the ſeveral manuſcripts, and conſidering the agreement of the words and ſenſe.

REAL, *reale*, is applied to a being that actually exiſts, in which ſenſe it coincides with actual.

REAL, in law, is oppoſed to perſonal.

Thus real action is that whereby the plaintiff lays title to land, &c.

REALGAR, *Riſigallum*, in the materia medica, a name whereby the ſandarach has been a long time known in the ſhops. It has been alſo attributed to the factitious red arſenic. See the articles SANDARACH and ARSENIC.

REALISTS, *Realiſtæ*, a ſect of ſchool philoſophers, formed in oppoſition to the Nominaliſts.

Under the Realiſts are included the Scotiſts, Thomiſts, and all excepting the followers of Ocham. Their diſtinguiſhing tenet is, that univerſals are realities, and have an actual exiſtence out of an idea, or imagination; or, as they expreſs it in the ſchools, a *parte rei*; whereas the Nominaliſts contend that they exiſt only in the mind, and are only ideas, or manners of conceiving things.

REALM, *Regnum*, a country which gives its head, or governor, the denomination of a king.

REAR, a term frequently uſed in compoſition, to denote ſomething behind, or backwards, in reſpect of another, in oppoſition to van; thus, in a military ſenſe, it is uſed for the hind part of an army, in oppoſition to the front.

REAR-DIVISION *of a Fleet*. A ſquadron of ſhips of war is always claſſed in three diviſions, commanded by three ſuperior officers, and are termed, the center, the van, and rear diviſion. The center is governed by the commander in chief, the van which advances firſt by the ſecond in command, and the rear, or laſt diviſion, by the next officer in rank. See CENTER, DIVISION, SQUADRON.

REASON,

REASON, *Ratio*, a faculty, or power, of the mind, whereby it diſtinguiſhes good from evil, truth from falſehood; whereby man is diſtinguiſhed from beaſts; and wherein it is evident he greatly ſurpaſſes them: or reaſon is that principle whereby, comparing ſeveral ideas together, we draw conſequences from the relations they are found to have.

Some define reaſon to be the comprehenſion of many principles which the mind ſucceſſively can conceive, and from which concluſions may be drawn. And others conceive reaſon as no other than the underſtanding itſelf conſidered as it diſcourſes.

Reaſon, Mr. Locke obſerves, contains two diſtinct faculties of the mind, viz. ſagacity, whereby it finds intermediate ideas; and illation, whereby it ſo orders and diſpoſes of them, as to diſcover what connection there is in each link of the chain, whereby the extremes are held together; and thereby, as it were, draws into view the truth ſought for. Illation, or inference, conſiſts in nothing but the perception of the connection there is between the ideas in each ſtep of the deduction, whereby the mind comes to ſee either the agreement or diſagreement of any two ideas, as in demonſtration, in which it arrives at knowledge; or their probable connection, on which it gives or with-holds its aſſent, as in opinion.

Senſe and intuition reach but a little way; the greateſt part of our knowledge depends upon deductions and intermediate ideas. In thoſe caſes where we muſt take propoſitions for true, without being certain that they are ſo, we would need to find out, examine, and compare the grounds of their probability. In both caſes the faculty which finds out the means, and rightly applies them to diſcover certainty in the one, and probability in the other, is that which we call reaſon. In reaſon, therefore, we may conſider four degrees. Firſt, the diſcovering and finding out of proofs.

Secondly, the regular and methodical diſpoſition of them, and laying them in ſuch order, as that their connection may be plainly perceived.

Thirdly, the perceiving of their connection. And,

Fourthly, the making a right concluſion.

Concerning reaſon, Mr. Locke thinks that ſyllogiſm, as was generally thought, is not the proper inſtrument of it, nor the uſefulleſt way of exerciſing this faculty.

Reaſon, though of very large extent, fails us in ſeveral inſtances; as firſt, where our ideas fail; ſecondly, it is often at a loſs, becauſe of the obſcurity, confuſion, or imperfection of the ideas it is employed about: thus, having no perfect idea of the leaſt extenſion of matter, nor of infinity, we are at a loſs about the diviſibility of matter. Thirdly, our reaſon is often at a ſtand, becauſe it perceives not thoſe ideas which would ſerve to ſhew the certain or probable agreement or diſagreement of any two other ideas. Fourthly, our reaſon is very often engaged in abſurdities and difficulties, by proceeding upon falſe principles, which being followed, lead men into contradictions to themſelves, and inconſiſtency in their own thoughts. Fifthly, dubious words, and uncertain ſigns, often puzzle men's reaſon, and bring them to a nonplus. Though the deducing one propoſition from another be a great part of reaſon, and that which it is uſually employed about, yet the principal act of ratiocination is the finding the agreement or diſagreement of two ideas one with another by the intervention of a third; as a man by a yard finds two houſes to be of the ſame length, which could not be brought together to meaſure their equality by juxta-poſition. Words have their conſequences as the ſigns of ſuch ideas; and things agree or diſagree with what they really are, but we obſerve it only by our ideas. Hence we may be able to form an idea of that ordinary diſtinction of things into thoſe that are according to, thoſe that are above, and thoſe contrary to, reaſon. Thoſe according to reaſon, are ſuch propoſitions whoſe truth we can diſcover by examining and tracing thoſe ideas we have from ſenſation and reflection, and by a natural deduction find to be true or probable. Above reaſon are ſuch propoſitions whoſe truth we, or probability cannot, by reaſon derive from theſe principles. Contrary to reaſon are ſuch propoſitions as are inconſiſtent with, or irreconcileable to, our clear and diſtinct ideas. Thus the exiſtence of one God is according to reaſon: the exiſtence of more than one God, contrary to reaſon; and the reſurrection of the body after death, above reaſon. Above reaſon may be alſo taken in a double ſenſe, viz. above probability, or above certainty.

Reaſon, as contradiſtinguiſhed to faith, Mr. Locke takes to be the diſcovery of the certainty or probability of ſuch propoſitions or truths, as the mind arrives at, by deductions made from ſuch ideas, which it has got by the uſe of its natural faculties, viz. by ſenſation or reflection; whereas faith, on the other hand, is the aſſent to any propoſition upon the credit of the propoſer, as coming immediately from God, which we call revelation.

This uſe of the word reaſon our author takes to be very improper; faith, as has been already obſerved, being nothing elſe but a firm aſſent of the mind, which if regulated, as is our duty, cannot be afforded to any thing but upon good reaſon, and ſo cannot be oppoſite to it.

REASON is alſo taken in different other ſignifications; ſometimes it denotes true and clear principles; ſometimes it is taken for clear and fair deductions from theſe principles; and ſometimes for the cauſe, particularly the final cauſe.

REASONING, RATIOCINATION, the exerciſe of that faculty of the mind called reaſon; or it is an act or operation of the mind, deducing ſome unknown propoſition from other previous ones that are evident and known.

It often happens in the comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application to one another: here then, as has been already obſerved under REASON, it becomes neceſſary to look out after ſome third idea that will admit of ſuch an application as the preſent caſe requires. Hence it appears that every act of reaſoning neceſſarily includes three diſtinct judgments; two wherein the ideas whoſe relation we want to diſcover, are ſeverally compared with the middle idea; and a third wherein they are themſelves connected, or disjoined, according to the reſult of that compariſon. Now, as our judgments when put into words are called propoſitions, ſo the expreſſions of our reaſonings are termed ſyllogiſms. And hence it follows that as every act of reaſoning implies three ſeveral judgments, ſo every ſyllogiſm muſt include three diſtinct propoſitions. See SYLLOGISM.

In order therefore to infer a concluſion by a ſingle act of reaſoning, the premiſes muſt be intuitive propoſitions; where they are not, previous ſyllogiſm are required, in which caſe reaſoning becomes a complicated act taken in a variety of ſucceſſive ſteps. This frequently happens in tracing the more remote relations of our ideas, where many middle terms being called in, the concluſion cannot be made out, but in conſequence of a ſeries of ſyllogiſms following one another in train. Hence we may clearly perceive that reaſoning, in the higheſt exerciſe of that faculty, is no more than an orderly combination of ſimple acts of reaſoning. See the article DEMONSTRATION.

Thus we ſee that reaſoning, beginning with firſt principles, riſes gradually from one judgment to another, and connects them in ſuch a manner that every ſtage of the progreſſion brings intuitive certainty along with it.

All the aims of human reaſoning may in the general be reduced to theſe two. 1. To rank things under thoſe univerſal ideas to which they truly belong; and, 2. To aſcribe to them their ſeveral attributes and properties in conſequence of that diſtribution.

This firſt aim of reaſon then is to determine the genera and ſpecies of things; and the ſecond end regards the ſciences and the affairs of common life. See GENUS, SPECIES, &c.

As in tracing the moſt diſtant relation of things we muſt always have recourſe to intervening ideas, and are more or leſs ſucceſsful in our reſearches, according to our acquaintance with thoſe ideas, and ability of applying them, it is evident that to make a good reaſoner two

things are principally required; firſt, an extenſive knowledge of thoſe intermediate ideas, by means of which things may be compared one with another; ſecondly, the ſkill and talent of applying them happily in all particular inſtances that come under conſideration.

There is another ſpecies of reaſoning with two propoſitions, which ſeems to be compleat in itſelf, and where we admit the concluſion without ſuppoſing any tacit or ſuppreſſed judgment in the mind from which it follows ſyllogiſtically. This happens between propoſitions where the connection is ſuch that the admiſſion of the one neceſſarily, and at the firſt ſight, implies the admiſſion alſo of the other: for if it falls out that the propoſition on which the other depends is ſelf evident, we content ourſelves with barely affirming it, and infer that other by a direct concluſion: thus, by admitting an univerſal propoſition, we are forced alſo to admit of all the particular propoſitions comprehended under it; this being the very condition that conſtitutes a propoſition univerſal. If then that univerſal propoſition chances to be ſelf evident, the particular ones follow of courſe, without any farther train of reaſoning.

Another ſpecies of reaſoning is that called by logicians induction; in order to the right underſtanding of which, it will be neceſſary to obſerve, that our general ideas are for the moſt part capable of various ſubdiviſions: thus the idea of the loweſt ſpecies may be ſubdivided into its ſeveral individuals; the idea of any genus into the different ſpecies it comprehends; and ſo of the reſt. If then we ſuppoſe this diſtribution to be duly made, ſo as to take in the whole extent of the idea to which it belongs, then it is plain that all the ſubdiviſions or parts of any idea taken together conſtitute that whole idea: thus the ſeveral individuals of any ſpecies taken together conſtitute the whole ſpecies, and all the various ſpecies comprehended under any genus make up the whole genus; this being allowed, it is apparent that whatever may be affirmed of all the ſeveral ſubdiviſions and claſſes of any idea, ought to be affirmed of the whole general idea to which theſe ſubdiviſions belong. What may be affirmed of all the individuals of any ſpecies, may be affirmed of the whole ſpecies; and what may be affirmed of all the ſpecies of any genus, may alſo be affirmed of the whole genus. This way of reaſoning, where we infer univerſally concerning any idea, what we had before affirmed or denied ſeparately of all its ſeveral ſubdiviſions and parts, is called reaſoning by induction: thus, if we ſuppoſe the whole tribe of animals ſubdivided into men, beaſts, birds, inſects and fiſhes, and then reaſon concerning them in this manner; all men have a power of beginning motion, all beaſts, birds, and inſects have a power of beginning motion, all fiſhes have a power of beginning motion; therefore all animals have a power of beginning motion.

RE-ATTACHMENT, in law, is a ſecond attachment of a perſon, who was formerly attached and diſmiſſed the court without day, on account of the not coming of the juſtices, or other ſuch caſualty: without which, a cauſe diſcontinued cannot be revived, but the defendant muſt plead de novo.

RE-BAPTISANTS, the ſame with Anabaptiſts. See ANABAPTISTS.

REBATE, or REBATEMENT, in commerce, a term much uſed at Amſterdam, for an abatement in the price of ſeveral commodities, when the buyer, inſtead of taking time, advances ready money.

Rebate, which among us is uſually called prompt-payment, is eſtimated by months, and is only allowed for certain merchandize, which, according to the cuſtom of Amſterdam, are

German wools,	which are ſold at	15	months rebate.
Spaniſh wools,		21	
Aſhes and pot-aſhes,		18	
Italian ſilks,		33	
Sugars of Brazil,		18	

That is, thoſe commodities are ſold for ready money, only deducting or rebating the intereſt of the money, which need not have been paid till the end of 15, 21, &c. months. This intereſt is uſually regulated on the foot of 8 *per cent. per annum.*

REBELLION, a traitorous taking up of arms againſt the king by his own natural ſubjects, or thoſe formerly ſubdued.

REBELLIOUS ASSEMBLY, in law, an aſſembling together of twelve or more perſons, with an intent of unlawfully making uſe of their own authority, to change or alter any laws of this kingdom, or to deſtroy the incloſures of any ground, or the banks of any fiſh-pond, pool, or conduit, to the intent that it may lie waſte and void; or to deſtroy the deer in any park, fiſh in fiſh-ponds, coneys in any warren; or any houſe, barn, mills, or bays; or to burn ſacks of corn, abate rents, or prices of victuals, &c. See the article RIOT.

REBUS, an ænigmatical repreſentation of ſome name, &c. by uſing figures or pictures inſtead of words, or parts of words.

REBUTTER, in law, the defendant's anſwer to the plaintiff's ſurrejoinder, in a cauſe depending in the court of Chancery, &c. alſo when a perſon warrants lands, &c.

RECAPITULATION, in oratory, &c. a part of the peroration.

Recapitulation is a ſummary, or conciſe and tranſient enumeration of the principal things inſiſted on in the preceding diſcourſe, whereby the force of the whole is collected into one view.

RECEIPT, or RECEIT, in commerce, an acquittance, or diſcharge, in writing, intimating that the party has received a certain ſum of money, either in full for the whole debt, or in part, or on account.

RECEIPT, in book-keeping, is an account of all the money and goods received. See the article BOOK-KEEPING.

RECEIVER, in chemiſtry, a veſſel of earth, glaſs, &c. for receiving any diſtilled liquor.

RECEIVER, in pneumatics, a glaſs-veſſel for containing the thing on which an experiment in the air-pump is to be made. See AIR-PUMP.

RECEIVER, RECEPTOR, or RECEPTATOR, in law, is commonly underſtood in a bad ſenſe, and uſed for ſuch as knowingly receive ſtolen goods from thieves, and conceal them. This crime is felony, and the puniſhment is tranſportation for fourteen years.

RECEPTACULUM CHYLI, or PECQUET'S RESERVATORY, the reſervoir or receptacle for the chyle, ſituated in the left ſide of the upper vertebra of the loins, under the aorta, and the veſſels of the left kidney.

RECEPTACULUM SEMINUM, receptacle of the ſeed, a term uſed by botaniſts, for the baſe, or thalamus, which ſupports the ſeeds: the diſc of this part is either flat, concave, convex, globular, or pyramidal; and its ſurface is ſometimes naked, and ſometimes paleaceous.

RECHABITES, a kind of religious order among the Jews, inſtituted by Jonadab, the ſon of Rechab, comprehending only his own family and poſterity.

Their founder preſcribed them three things: firſt, not to drink any wine; ſecondly, not to build any houſes, but to dwell in tents; and thirdly, not to ſow any corn, or plant vines. Theſe rules the Rechabites obſerved with great ſtrictneſs.

RECHARGE, a ſecond charge or loading of fire-arms.

RECHEAT, in hunting, a leſſon which the huntſmen play on the horn when the hounds have loſt their game, to call them back from purſuing a counter-ſcent.

RECIPE, in medicine, a preſcription or remedy, to be taken by a patient; ſo called becauſe always beginning with the word *Recipe*, that is, *Take*; which is generally denoted by the abbreviature ℞.

RECIPIANGLE, or RECIPIENT-ANGLE, a mathematical inſtrument, ſerving to meaſure re-entering and ſaliant angles, eſpecially in fortification.

RECIPROCAL, in general, ſomething that is mutual, or which is returned equally on both ſides, or that affects both parties alike.

There are reciprocal duties between the prince and his ſubjects, between the huſband and wife, &c. alſo in a phyſical ſenſe, the action between the agent and patient is reciprocal: that is, the patient re-acts as much upon the agent, as this acts upon it. See RE-ACTION.

RECIPROCAL TERMS, among logicians, are thoſe which have the ſame ſignification; and conſequently are convertible, or may be uſed for each other.

RECIPROCAL VERSES, in grammar, are thoſe which expreſs an action that is reflected upon the agent or agents, as,

Ces quatre hommes s'entrebattoient.

Theſe four men fought together.

Reciprocal verſes, in poetry, are ſuch as run the ſame both forwards and backwards.

RECIPROCAL FIGURES, in geometry, thoſe which have the antecedents and conſequents of the ſame ratio, in both figures.

RECIPROCAL PROPORTION, in arithmetic, is when, in four numbers, the fourth is leſs than the ſecond, by ſo much as the third is greater than the firſt; and *vice verſa*. See PROPORTION.

RECITATIVO, or RECITATIVE, in muſic, a kind of ſinging, that differs but little from ordinary pronunciation, ſuch as that in which the ſeveral parts of the Liturgy are rehearſed in cathedrals; or that wherein the actors commonly deliver themſelves on the theatre at the opera, when they are to expreſs ſome action or paſſion, to relate ſome event, or reveal ſome deſign.

RECKONING, in navigation, is the eſtimation of a ſhip's courſe at ſea, as meaſured by the log-line and glaſs. See DEAD RECKONING, GLASS, JOURNAL, LOG, and NAVIGATION.

The place of the ſhip is diſcovered in the reckoning by taking the ſeveral differences of latitude and departure from the different courſes the ſhip has run, and adding them together, if ſhe has only run in one quadrant of the horizon, to obtain the total difference of latitude and departure made for a certain period, as 24 hours, and conſequently the latitude and longitude into which the ſhip has arrived.

The journal in which this reckoning is formally ſtated, together with all the material events which happen in the courſe of a voyage, is variouſly kept, according to the fancy or caprice of the navigator. In the royal navy, indeed, there is a regular uniform method which all the officers obſerve; which, however, is not ſo accurate as might perhaps be expected.

The following method ſeems better calculated for this purpoſe. Let every page of the journal contain two days works, and a ſpace be left at the bottom of both pages for the azimuths, amplitudes, bearings, diſtances, and variations, as follows:

Daily regiſter kept aboard the Minerva in the year 1700.

♄ November 19. At 4 P. M. Lizard bore N. W. four leagues. Moderate gales. Smooth ſea and drizzling ſhewers.	Courſe S. 16° W. Diſtance 112. Latitude per acct. Longitude made Meridian diſtance from the Lizard.	☽ Nov. 21. Strong gale and heavy ſea at ½ paſt 1 P. M. Cloſe reefed. Main and fore-top-ſail furled: mizen ditto.	Courſe Diſtance Latitude Longitude Merid^{n} diſtance
Saw three ſail in the S. E. quarter.		Cloudy, with rain and gleams of lightning. Storm ceaſes. Furled the top-ſails, and got down the top-gallant yards.	
Fair weather and a freſh gale.		Very high ſea breaking over the ſhip. Secured the boats with frappings.	Drift under ballanced mizen.
Latitude obſerved at noon.	[In this column are to be inſerted, after the day's work is corrected, the courſe, diſtance, &c. oppoſite to the words.]	Violent ſtorm. Furled the main-ſail and fore-ſail, and lay to under ballanced mizen. Ship labours extremely.	
		Launched the guns over-board.	
☉ Nov. 20. The firſt part of this 24 hours, freſh gales and a clear ſky, the middle and latter parts cloudy, with ſprinkling rain, and a ſwelling ſea from the N. W.	Courſe Diſtance Latitude Longitude Merid^{n} diſtance	♂ Nov. 22. Tempeſt continues, accompanied with a high and dangerous ſea. Ship very leaky.	Courſe Diſtance Latitude Longitude Merid^{n} diſtance
The wind ſtrengthening, reefed the top-ſails.		At 5 P. M. a heavy ſea broke aboard, and carried away the boat, and three men off the deck, and ſplit the mizen. Brought to another and ſet. Ship continues very leaky.	
No obſervations to-day.		Labours and pitches exceſſively.	
		At ½ paſt 7 P. M. by a heavy pitch the bowſprit was carried away, which was immediately followed by the fore-maſt and main-top-maſt.	
At ten A. M. double reefed the top-ſails.		Thunder, lightning, and meteors, at the maſt-head. The ſtorm abates.	
		Heavy rain.	

Azimuths, Amplitudes, Bearings, Diſtances, and Variations for the four Days.

☉ This morning found the ſun's azimuth by a good obſervation 75° 30′: his altitude was then 9° 30′. The true amplitude 67° 4′, which makes the variation 8° 26′.

Bearing and diſtance of the Lizard.

Bearing and diſtance of Cape Ortugal in Spain.

RECLAIMING, or RECLAMING, in our ancient cuſtoms, a lord's purſuing, proſecuting, and recalling his vaſſal, who had gone to live in another place without his permiſſion.

RECLINER, or RECLINING DIAL. See the article DIALLING.

RECLUSE, among the papiſts, a perſon ſhut up in a ſmall cell of an hermitage, or monaſtery, and cut off, not only from all converſation with the world, but even with the houſe. This is a kind of voluntary impriſonment, from a motive either of devotion or penance.

RECOGNITION, in law, an acknowledgment; a word particularly uſed in our law books, for the firſt chapter of the ſtatute 1 Jac. I. by which the parliament acknowledged, that, after the death of queen Elizabeth, the crown had rightfully deſcended to king James.

RECOGNIZANCE, or RECOGNISANCE, in law, a bond or obligation of record, acknowledged to the king: thus called, becauſe recognized or acknowledged in ſome court of record, or before ſome judge, maſter in chancery, or juſtice of the peace.

RECOIL, or REBOUND, the ſtarting backward of a fire-arm, after an exploſion.

Merſennus tells us, that a cannon 12 feet in length, weighing 6400 ℔. gives a ball of 24 ℔. an uniform velocity of 640 feet per ſecond. Putting therefore, $W = 6400$, $w = 24$, $V = 640$, and $v =$ the velocity with which the cannon recoils; we ſhall have (becauſe the momentums of the cannon and ball are equal) $Wv = wV$; and ſo $v = \frac{wV}{W} = \frac{24 \times 64}{6400} = 2,4$; that is, it would recoil at the rate of $2\frac{4}{10}$ feet per ſecond, if free to move.

RECOLLECTION, a mode of thinking, by which ideas ſought after by the mind, are found, and brought again to view.

RECOLLECTS, a congregation of reformed Franciſcans, called alſo friers-minors of St. Francis, of the ſtrict obſervance. See FRANCISCANS.

RECONNOITRE, in war, to view and examine the ſtate and ſituation of things.

RECORD, an authentic teſtimony in writing, contained in rolls of parchment, and preſerved in a court of record.

RECORDER, a perſon whom the mayor and other magiſtrates of a city or corporation aſſociate to them, for their better direction in matters of juſtice, and proceedings in law; on which account this perſon is generally a counſellor, or other perſon well ſkilled in the law.

RECOVERY, in law, is obtaining any thing by judgment or trial at law.

Recoveries are of two kinds, a true recovery, and a feigned or common one. A true recovery is the actual recovering of any thing, or its value, by judgment and trial at law: as where a perſon is ſued for land, or other things real and perſonal, and obtains a verdict in his favour. A feigned or common recovery, is a formal act by conſent, made uſe of for the better ſecuring of lands, tenements, &c. the end and effect of which is, to dock and deſtroy eſtates-tail, remainders. and reverſions, and to bar the former owners.

RECREMENT, in chemiſtry, ſome ſuperfluous matter ſeparated from ſome other that is uſeful: in which ſenſe it is the ſame with ſcoriæ, fæces, and excrements. See SCORIÆ, &c.

RECRIMINATION, in law, an accuſation brought by the accuſed againſt the accuſer, upon the ſame fact.

RECRUITS, in military affairs, new-raiſed ſoldiers, deſigned to ſupply the place of thoſe who have loſt their lives in the ſervice, or are diſabled by age or wounds.

RECTANGLE, in geometry, the ſame with a right-angled parallelogram.

In arithmetic and algebra, a rectangle ſignifies the ſame with factum or product.

RECTANGLED, RECTANGULAR, or RIGHT-ANGLED, appellations given to figures and ſolids which have one or more right-angles: thus a triangle with one right angle, is termed a rectangled triangle; alſo parallelograms with right-angles, ſquares, cubes, &c. are rectangular.

Solids, as cones, cylinders, &c. are alſo ſaid to be rectangular, with reſpect to their ſituation, when their axes are perpendicular to the plane of the horizon.

The ancient geometricians always called the parabola, the rectangular ſection of a cone.

RECTIFICATION, the art of ſetting any thing to rights: and hence, to rectify the globes, is to fit them for performing any problem.

RECTIFICATION, in geometry, is the finding a right line, equal in length to a curve. See the article CURVE.

RECTIFICATION, in chemiſtry, is nothing but the repetition of a diſtillation, or ſublimation ſeveral times, in order to render the ſubſtance purer, finer, and freer from aqueous or earthy parts.

The perfection of rectifying ſpirits, according to Dr. Shaw, depends upon finding out a ſimple method of ſeparating all the oil and water from it; and, he obſerves, that the great affinity betwixt the eſſential oil and ſpirit, is the phyſical cauſe of the difficulty found in the rectification of brandies. He recommends the way of working from a ſpirit largely diluted with water, into water again; whereby the eſſential oil would, at one operation, be doubly ſeparated.

RECTIFIER, in navigation, an inſtrument conſiſting of two parts, which are two circles either laid one upon, or let into, the other, and ſo faſtened together in their centers, that they repreſent two compaſſes, one fixed, the other moveable; each of them divided into the thirty-two points of the compaſs, and three hundred and ſixty degrees, and numbered both ways, from the north and the ſouth, ending at the eaſt and weſt, in ninety degrees.

The fixed compaſs repreſents the horizon, in which the north and all the other points of the compaſs are fixed and immoveable.

The moveable compaſs repreſents the mariners compaſs, in which the north and all other points are liable to variation.

In the center of the moveable compaſs is faſtened a ſilk thread, long enough to reach the outſide of the fixed compaſs. But, if the inſtrument be made of wood, there is an index inſtead of the thread.

Its uſe is to find the variation of the compaſs, to rectify the courſe at ſea; having the amplitude or azimuth given.

RECTILINEAR, in geometry, right-lined; thus figures whoſe perimeter conſiſts of right lines, are ſaid to be rectilinear.

RECTITUDE, *Rectitudo*, in philoſophy, refers either to the act of judging or of willing; and therefore whatever comes under the denomination of rectitude is either what is true or what is good; theſe being the only objects about which the mind exerciſes its two faculties of judging and willing.

RECTOR, a term applied to ſeveral perſons whoſe offices are very different: as, 1. The rector of a pariſh is a clergyman that has the charge and cure of a pariſh, and poſſeſſes all the tythes, &c. 2. The ſame name is alſo given to the chief elective officer in ſeveral foreign univerſities, particularly in that of Paris. 3. Rector is alſo uſed in ſeveral convents for the ſuperior officer who governs the houſe: and the Jeſuits give this name to the ſuperiors of ſuch of their houſes as are either ſeminaries or colleges.

RECTORY, a pariſh church, parſonage, or ſpiritual living, with all its rights, tythes, and glebes.

RECTUM, in anatomy, the third and laſt of the large inteſtines, or guts.

The rectum is in length about three hands breadth, and its diameter about three fingers. It has its beginning at the lower vertebræ of the loins, and at the lower end is the anus.

It is connected to the os ſacrum, the os coccygis, and the urinary bladder in men, but in women to the vagina uteri. The coats of the rectum are more thick and fleſhy than thoſe of any other of the inteſtines: it has in general no valves, but it has ſeveral rugæ: the abſence of valves here, is to prevent the expulſion of the fæces from being retarded.

RECTUS,

RECTUS, in anatomy, a name common to ſeveral pair of muſcles, ſo called on account of the ſtraightneſs of their fibres, as, 1. The rectus major anticus, which ariſes from the tranſverſe apophyſes of the five lower vertebræ of the neck, and is inſerted into the os occipitis. 2. The rectus minor anticus, called, by Cowper, muſculus annuens: this ariſes from the anterior ſurface of the atlas, or firſt vertebra of the neck; and lies concealed, as it were, under the former, till it is at length inſerted a little behind it, into the os occipitis: theſe two pair of muſcles ſerve to move the head forward. 3. The rectus major poſticus, one of the extenſors of the head, which has its origin from the ſpinoſe apophyſis of the epiſtrophæus, and is inſerted into the os occipitis. 4. The rectus minor poſticus, which is alſo one of the five extenſors of the head, has it riſe from the poſterior part of the atlas, and its end under the former. 5. The rectus lateralis, which ſerves to bend the head on one ſide, has its origin from the upper ſurface of the tranſverſe apophyſis of the atlas; from this it aſcends ſtrait with a ſhort body, but conſiderably thick; and is inſerted partly into the os occipitis, and partly into the temporal bone, near the inciſure of the maſtoide proceſs. 6. The rectus tibiæ, one of the four extenſors of the leg, which has its origin from the anterior and inferior ſpine of the ileum.

RECURRENTS, in anatomy, a name given to ſeveral large branches of nerves ſent out by the par vagum, from the upper part of the thorax to the larynx.

Recurrent Verses are the ſame with thoſe called reciprocal. See Reciprocal.

RECUSANTS, ſuch perſons as acknowledge the pope to be the ſupreme head of church, and refuſe to acknowledge the king's ſupremacy; who are hence called popiſh recuſants. Theſe are in England charged with double taxes, not merely as Romaniſts, but as recuſants.

RECUSATION, the deſiring a judge to refrain from judging in a certain cauſe, on account of his kinſhip, capital enmity, &c. to one of the parties.

RED, in phyſics, one of the ſimple or primary colours of natural bodies, or rather of the rays of light. See Colour, Light, and Ray.

The red rays are thoſe which of all others are the leaſt refrangible: hence, as Sir Iſaac Newton ſuppoſes the different degrees of refrangibility ariſe from the different magtudes of the luminous particles whereof the rays conſiſt, the red rays, or red light, is concluded to be that which conſiſts of the largeſt particles. Authors diſtinguiſh three general kinds of red; one bordering on the blue, as columbine, or dove-colour, purple, and crimſon. Another bordering on yellow, as flame-colour and orange; and between theſe extremes is a medium, partaking neither of the one nor the other, which is what we properly call red. Mr. Boyle obſerves, that red is an obvious, and generally a pleaſing colour; and that anciently it was cuſtomary to preſent red objects to elephants, to render them more fierce; and that the ſame colour irritates turkey-cocks. He obſerves alſo, that among the ſeveral changes of colour which bodies acquire, or diſcloſe, by digeſtion, it is very remarkable to find a redneſs rather than any other colour in moſt tinctures; and even in the more groſs ſolutions made of almoſt all concretes that abound either with mineral or vegetable ſulphur, though the menſtruum employed about theſe ſolutions, or tinctures, be never ſo limpid.

Red, in heraldry. See the article Gules.

Red-Book of the Exchequer, an ancient record or manuſcript volume, in the keeping of the king's remembrancer, containing divers miſcellany treatiſes relating to the times before the Conqueſt.

REDDLE, a ſoft, heavy red marle, of great uſe in colouring; and being waſhed and freed from its ſand, is often ſold by our druggiſts under the name of bole-armenic.

REDEMPTION, in law, a faculty or right of re-entering upon lands, &c. that have been ſold and aſſigned, upon re-imburſing the purchaſe money with legal coſts.

REDENS, Redans, or Redant, in fortification, a kind of work indented in form of the teeth of a ſaw, with ſaliant and re-entering angles, to the end that one part may flank or defend another. It is called ſaw-work and indented work. The faces in this, flank one another. Redens are frequently uſed in the fortifying of walls, where it is not neceſſary to be at the expence of building baſtions; as when they ſtand on the ſide of a river, a marſh, the ſea, &c.

REDOUBT, or Redoute, *Reductus*, in fortification, a ſmall ſquare fort, without any defence but in front, uſed in trenches, lines of circumvallation, contravallation, and approach, as alſo for the lodgings of corps de garde, and to defend paſſages. In marſhy grounds, redoubts are frequently made of ſtone-works, for the ſecurity of the neighbourhood; their face conſiſts of from ten to fifteen fathom, the ditch round them from eight to nine feet broad and deep, and their parapets have the ſame thickneſs.

REDUCT, or Reduit, a military term ſignifying an advantageous piece of ground, entrenched, and ſeparated from the reſt of the place, camp, &c. for an army, garriſon, &c. to retire to in caſe of a ſurprize.

Reduct, in building, a quirk or little place taken out of a larger to make it more uniform and regular; or for ſome other convenience, as for a little cabinet aſide of a chimney, for alcoves, &c.

Reduct, or Redux, among chemiſts, a powder by which calcined metals and minerals are again reduced to their regulus, or pure ſubſtance.

REDUCTION, *Reductio*, in the ſchools, a manner of bringing a term or propoſition which was before oppoſite to ſome other to be equivalent to it.

Reduction *of Syllogiſms*, is a regular changing or transforming of an imperfect ſyllogiſm into a perfect one; or it is a change of a ſyllogiſm in reſpect of form, whereby the neceſſity of the illation or inference is made more evident. See Syllogism.

Reduction, in arithmetic, that rule whereby numbers of different denominations are brought into one denomination. Reduction is but the application of multiplication and diviſion. For, firſt, a higher denomination is brought into a lower one, by multiplying the higher denomination with ſo many of the lower as are contained in the higher; ſtill keeping them equivalent in value. This is called reduction deſcending. Secondly, a lower or inferior denomination is reduced into a higher or ſuperior one, by dividing the leſſer one with ſo many of its denomination as is contained in the greater. This is the converſe of the laſt, and is termed reduction aſcending. Thus pounds are reduced into ſhillings by multiplying with 20; ſhillings into pence, by multiplying with 12; and pence into farthings, by multiplying with 4. On the other hand, ſhillings are reduced into pounds, by dividing with 20; pence into ſhillings, by dividing with 12; and farthings into pence, by dividing with 4.

Examples. Let it be required to reduce 357 l. into ſhillings, and thoſe ſhillings into pence; $357 \times 20 = 7140$ = the ſhillings in 357 l. and $7140 \times 12 = 85680$ = the pence in 357 l. as was required. Again, let it be required to reduce 85680 d. into ſhillings, and thoſe ſhillings into pounds; $85680 \div$ by $12 = 7140$ = the ſhillings in 357 l. and $7140 \div$ by $20 = 357$ l. as was required.

If there remain any thing in each diviſion, it is reſpectively either odd pence, ſhillings, or farthings; thus 4123788 farthings, being reduced, give 4295 l. 12 s. 3 d.

But when the numbers propoſed to be reduced are of ſeveral denominations, and it is required to bring them all to the loweſt, you muſt reduce, as before, the higheſt or greateſt denomination to the next leſs, adding the numbers that are of that next denomination together; then reduce their ſum to the next lower denomination; adding together all the numbers that are of that denomination, and ſo proceed gradually on until all is done.

Reduction *of Fractions*. See the article Fraction.

Reduction *of Equations*, in algebra. See the article Equation.

Reduction *of a Figure, Deſign, or Draught*, is the making a copy thereof either larger or ſmaller than the original; ſtill preſerving the form and proportion. The great uſe of the proportional compaſſes is the reduction of figures, &c. whence they are called compaſſes of reduction.

There are various methods of reducing figures, &c. The moſt eaſy is by means of the pentagraph, or parallelogram. See Pentagraph.

REDUCTION *to the Ecliptic*, in aſtronomy. The place of any ſtar reduced to the ecliptic, is that point where the ſecundary paſſing through the ſtar interſects the ecliptic.

REDUCTION, in metallurgy, is the bringing back metalline ſubſtances which have been changed into ſcoriæ or aſhes, or otherwiſe diveſted of their metallic form, into their natural and original ſtate of metals again.

REDUCTION, in ſurgery, denotes an operation whereby a diſlocated, luxated, or fractured bone is reſtored to its former ſtate or place. See the articles LUXATION and FRACTURE.

REDUNDANCY, or REDUNDANCE, a fault in diſcourſe, conſiſting in the uſe of a ſuperfluity of words. Words perfectly ſynonymous are redundant, and ought to be retrenched.

REDUNDANT HYPERBOLA, is a curve of the higher kind, thus called, becauſe it exceeds the conic ſection of that name, in the number of its hyperbolical legs; being a triple hyperbola with ſix hyperbolical legs.

REDUPLICATION, in rhetoric, a figure whereby a verſe begins with the ſame word as the preceding one ends with.

REDUPLICATION, in logic, a kind of condition expreſſed in a propoſition indicating or aſſigning the manner wherein the predicate is attributed to the ſubject. Hence reduplicative propoſitions are ſuch wherein the ſubject is repeated with ſome circumſtance or condition. Thus, "Men, as men, are rational: kings, as kings, are ſubject to none but God"

REED, an ancient Jewiſh meaſure. See the article MEASURE.

REEF, in naval affairs, certain ſpaces or diviſions of the ſail, which are taken in, or let out, in proportion to the increaſe or diminution of the wind. In a ſquare ſail they are placed parallel to its upper edge, below one another, at equal diſtances, each reef containing about a ſeventh part of the ſail's depth, and are thus formed: at the bottom of each diviſion there is a row of holes ſtretching acroſs the ſail, through which are inſerted a number of platted cords, called points, in length each about twice the circumference of the yard, and theſe bind the intermediate ſpace of canvas in plaits cloſe up to the yard, from end to end; the ſail being lowered ſlack down for that purpoſe.

REEF-LINES are uſed to the courſes only, and are paſſed in ſpiral turns through the holes of the reef, and over the head of the ſail ſucceſſively, till they reach the extremities of the reef, and then being hauled tight, draw it cloſe up to the yard.

REEF-TACKLES are ropes which run through holes at each top-ſail yard-end, and are faſtened down on the edge or leech of the top-ſail, immediately under the loweſt reef. By hauling up theſe tackles the reef-band, which contains the holes, is bound cloſe up to the yard, for the more readily tying the points.

REEL *of the Log*, in naval affairs, a ſort of winch, or roller, containing four or five ſpokes, and an axis; upon which is wound the log line, which meaſures a ſhip's way at ſea. See the article LOG.

REEL, in the manufactories, a machine ſerving for the office of reeling. There are various kinds of reels, ſome very ſimple, others very complex. Of the former kinds thoſe moſt in uſe are, 1. A little reel held in the hand, conſiſting of three pieces of wood, the biggeſt and longeſt whereof, which does not exceed a foot and a half in length, and $\frac{1}{4}$ of an inch in diameter, is traverſed by two other pieces diſpoſed different ways. 2. The common reel, or windlace, which turns upon a pivot, and has four flights traverſed by long pins or ſticks, whereon the ſkain to be reeled is put, and which are drawn cloſer or opened wider, according to the ſkain. A repreſentation of the common reel may be ſeen in plate CIX. *fig.* 1. where A is the bench or ſeat of the reel, B the two uprights, C the arms of the reel; its arbor turning and hitching its little lantern of four notches in the teeth of the wheel. D two wheels, the upper one of which moves the lower, by means of a pinion. E a hammer, the handle whereof is lowered by a peg at the bottom of the lower wheel. F a cord which is rolled round the axle of the lower wheel, and ſupports a weight which ſtops after a certain number of turns, to regulate the work-woman. See the article SILK.

REELING, in the manufactories, the winding of thread, ſilk, cotton, or the like, into a ſkain, or upon a bottom, to prevent its entangling. It is alſo uſed for the charging or diſcharging of bobbins or quills, to uſe them in the manufacture of different ſtuffs, as thread, ſilk, cotton, &c. Reeling is performed different ways and on different engines.

RE-ENTRY, in law, ſignifies the reſuming or retaking that poſſeſſion which any one had lately foregone; as where a perſon makes a leaſe of lands to another, the leſſor thereby quits the poſſeſſion, and if the leſſee covenants that upon non-payment of the rent reſerved, the leſſor may lawfully re-enter, being as much as if it was conditioned for the leſſor to take the land again into his hands, and recover the poſſeſſion again by his own act without the aſſiſtance of the law.

REEVE *of a Church*, the guardian of it, or the churchwarden.

REEVING, in the ſea-language, the act of thruſting a rope through any hole, particularly through the channels of ſeveral blocks, to form a tackle or compliication of pullies.

RE-EXCHANGE, in commerce, a ſecond payment of the price of exchange, or rather the price of a new exchange due upon a bill of exchange that comes to be proteſted, and to be refunded the bearer by the drawer or indorſer.

REFECTION, among eccleſiaſtics, a ſpare meal or repaſt juſt ſufficing for the ſupport of life: hence the hall in convents, and other communities, where the monks, nuns, &c. take their refections or meals in common, is called the refectory.

REFERENCE, in writing, &c. a mark relative to another ſimilar one in the margin, or at the bottom of the page, where ſomething omitted in the text is added, and which is to be inſerted either in reading or copying.

REFINING, in general, is the art of purifying a thing; including not only the aſſaying or refining of metals, but likewiſe the clarification of liquors.

REFINING *of Gold* is performed three ways, viz. either with antimony, ſublimate, or aqua fortis; the laſt of which is the moſt uſual, and is called depart, or quartation. To refine gold with antimony, they make uſe of a wind furnace, and a common crucible of a ſize anſwerable to the quantity of gold to be refined; always taking care that the gold and antimony, both together, do not fill the crucible more than half full. After the gold is melted in the crucible, the antimony is thrown in in powder: the proportion of the antimony to the gold is eight ounces to a pound, if the gold be between ſixteen and twenty-two carats fine; if it be under ſixteen carats, then they uſe five quarters of a pound to eight ounces of gold; and ſtill the greater quantity of antimony is required, the coarſer the gold is.

As ſoon as they have put the antimony into the crucible they cover it, and after they have charged the furnace with charcoal, they put on the capital, which is let to ſtand till ſuch time as the crucible is left quite bare; then they take off the capital, and leave the crucible to cool in the furnace of itſelf, till ſuch time as they can take it out by the hand; then they break it, to get out the button, or culot, which is a maſs of fine gold, remaining at the bottom, with the fæces of the antimony, the ſilver and copper alloy, and ſometimes little particles of gold itſelf over it.

But notwithſtanding the gold thus prepared is very pure, yet the antimony gives it ſuch a harſh brittle quality, that it ceaſes to be ductile, and muſt be ſoftened by the fire with ſalt petre and borax, to bring it to itſelf. In order to this operation, they prepare what is called a dry-coppel, which is a coppel made of crucible earth, that does not imbibe like the coppels made of aſhes. When the coppel has been ſufficiently heated in the refining furnace, they put the gold into it, and cover it over with charcoal. As ſoon as the gold is diſſolved, which is very ſoon, by reaſon of the remains of the antimony, they blow

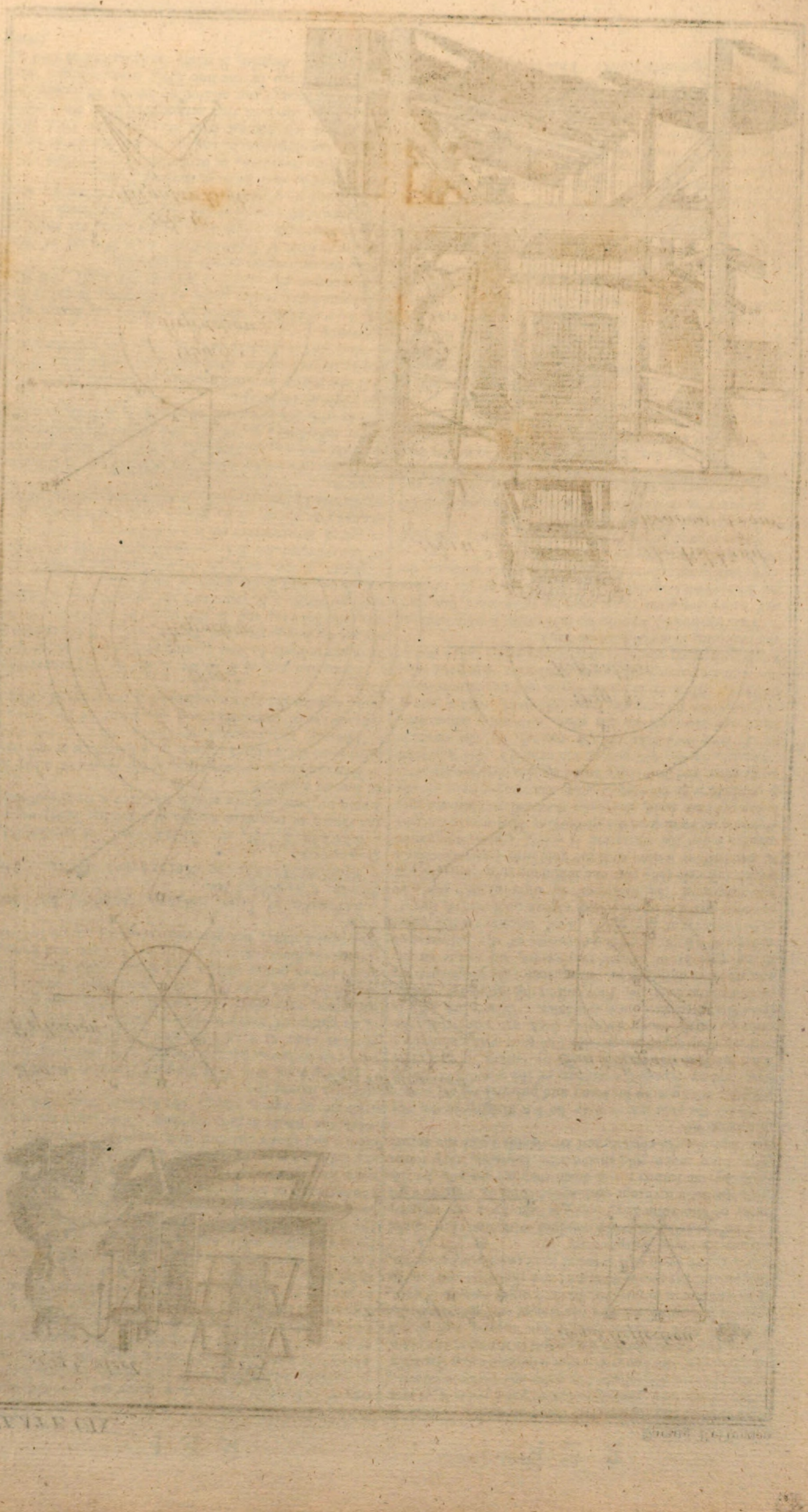


Fig. 1. Reel.

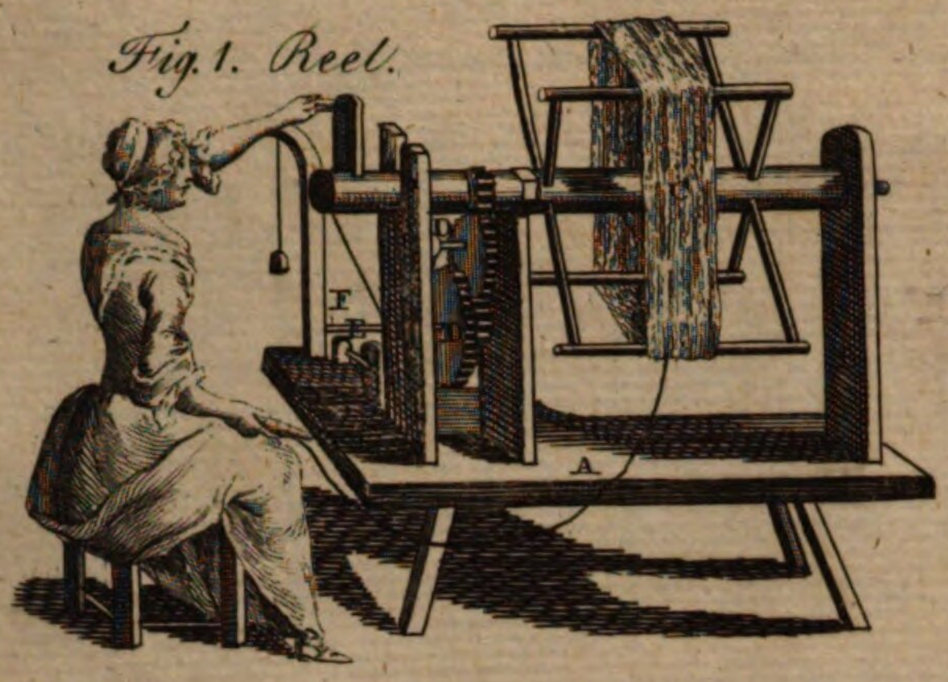


Fig. 2. Reflection.

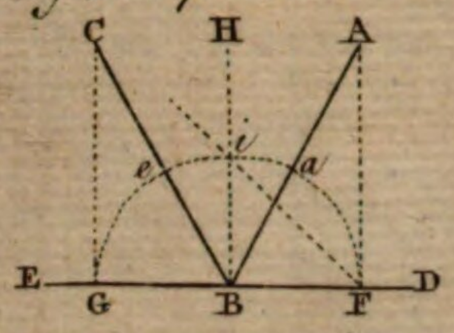


Fig. 3. Reflection.

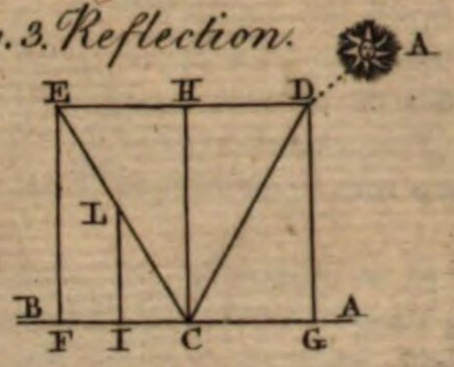


Fig. 4

Reflection.

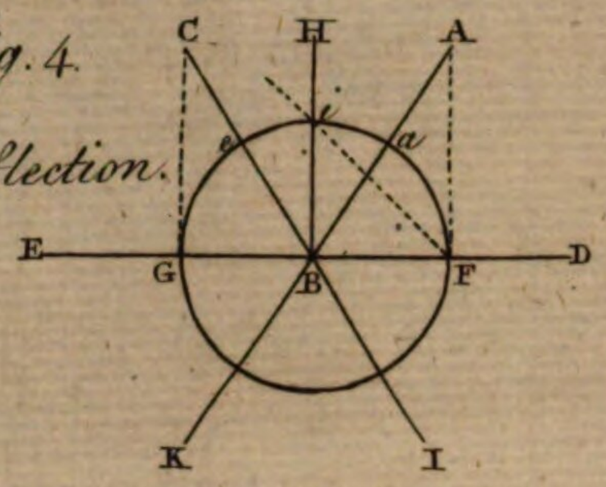


Fig. 5. Refraction.

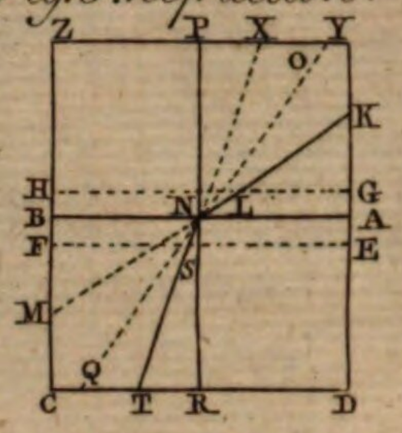
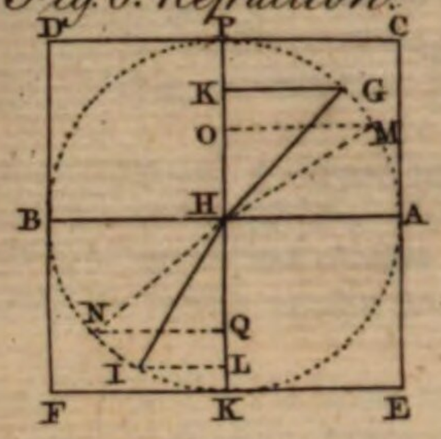


Fig. 6. Refraction.



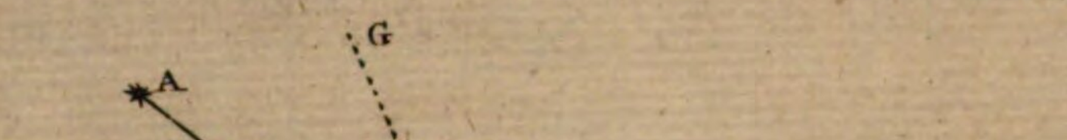


Fig. 7.

Refraction.

Fig. 8.

Refraction.

Fig. 9.

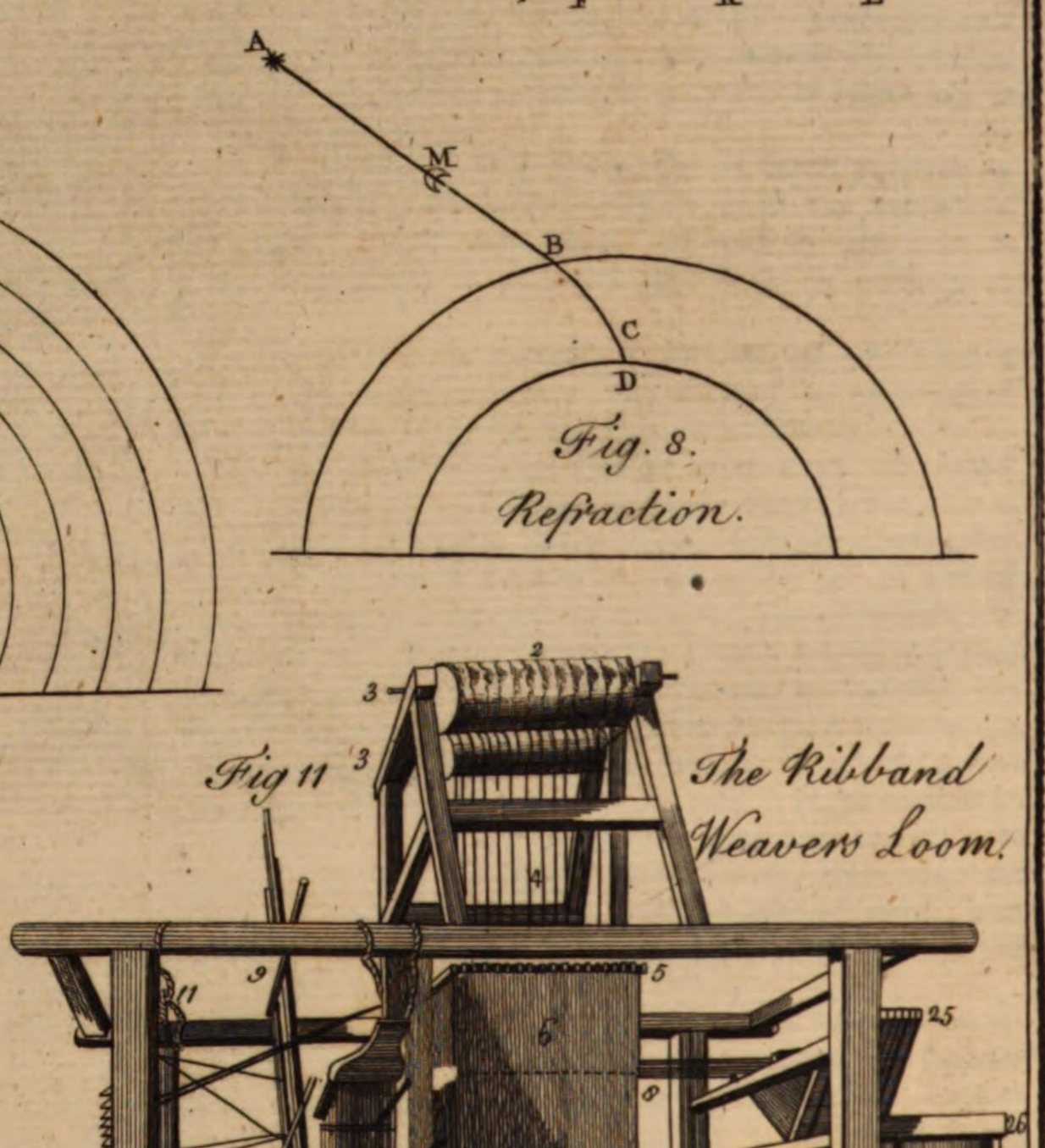
Refraction.

Fig. 10.

Regular Bodies.

Fig 11

The Kibband Weavers Loom.



blow it with the bellows to drive the mineral entirely away, which now goes off in ſmoak; and add to it, as ſoon as the fumes ceaſe, a little ſalt-petre and borax in powder, which collect the impurities that remained upon the diſſolution, and fix the gold in the coppel in the form of a plate. Then the gold is taken out of the coppel, and melted again in a crucible, with an addition of two ounces of ſalt-petre and borax in powder, to each eight ounces of gold, as ſoon as it has ceaſed to fume; and then it is caſt into an ingot, which upon trial is found to be twenty-three carats, twenty-ſix thirty ſeconds fine.

The particles of gold, detained with the alloy in the fæces of the antimony, are got out by a dry coppel, with the ſame meltings and ingredients, as were uſed in ſoftening the former: and when they are certain, by the aſſay, how much gold that matter contains, they refine it to ſeparate the copper, and afterwards make the depart or quartation.

As for the gold which may be left ſticking to the dry coppels, it is got by breaking and pulverizing the crucibles, and by repeated waſhings of the powder of them. The method of refining gold by means of ſublimate is this; they begin the proceſs like that with antimony; that is, in the ſame furnace, with the ſame coal, the ſame fire, and the ſame crucibles. When the gold is melted in the crucible, they caſt in the ſublimate, not in powder, but only broken into pieces: the proportion is, if the gold be of twenty-two carats, an ounce or an ounce and a half, or even two ounces of the ſublimate to eight ounces of the gold; if of twenty carats, three ounces; and if it be only from eighteen to twelve, five or ſix ounces of the ſublimate to eight of the gold, in which laſt caſe they part the ſublimate into two, and put in one half at a time with the gold into a new crucible; which, when the operation is over, leaves the gold of eighteen or twenty carats, according as it was in fineneſs before. This done, they put the broken ſublimate into a crucible with the melted gold, covering it immediately to ſmother the mineral; and then fill the furnace with charcoal, having firſt put on the capital; after a quarter of an hour they take off the capital, lay the crucible bare, and blow off all the aſhes and other impurities, that may be floating on the liquid gold, with a pair of bellows. This is repeated again, till the impurities of the gold are carried off by the ſublimate appearing of a bright glittering colour; after which being taken out of the crucible, it is caſt into an ingot.

This method of refining by ſublimate, is both cheaper and more complete than that by antimony; but they are both exceeding dangerous, by reaſon of the ſulphureous and arſenical exhalations; on which account the method of quartation is moſt practiſed.

REFINING *of Silver* is performed two ways; one with lead, and the other with ſalt-petre.

In order to refine ſilver with lead, a coppel is filled with a mixture of brick-aſhes and aſhes of bullocks and other bones.

It is ſet on the fire, and heated red-hot, in which ſtate the ſilver and lead are put in together, in the proportion of a pound of lead to eight ounces of ſilver, and even ſomewhat more lead, if the ſilver be very coarſe.

As theſe two metals melt together, the copper before mixed with the ſilver diſſipates into ſmoak, or goes away with the ſcum; and ſo does the lead itſelf, leaving the ſilver alone in the coppel in its proper degree of fineneſs.

In this method of refining, wherein ſix or ſeven thouſand pounds may be refined at once, the metal is drawn out of the coppel two ways; the one by plunging in it, while ſtill liquid, a thick bar of iron, round which the ſilver ſticks in form of a ſhell or cruſt, repeating this again and again; the other is by letting the coppel ſtand till it is cold; in the bottom of which, the ſilver fixes in form of a cake.

This method of refining ſilver with lead, is both the beſt and the cheapeſt; however, for want of workmen who underſtand it, that with ſalt petre ſtill obtains in many places; which is performed in a wind furnace. They firſt reduce the ſilver to be refined into grains, about the ſize of a ſmall pea; which is done by firſt melting it, then throwing it into a tub of common water, and then heating it over again in a boiler. This being done, they put it into a crucible; putting to every eight ounces of ſilver two of ſalt-petre. Then they cover the crucible with an earthen lid, in the form of a dome, exactly luted; which lid, however, muſt have a little aperture in the middle. The crucible being ſet into the furnace, and covered with charcoal, which is only to be lighted by degrees, at length they give it the full force of the fire, to put the metal into a perfect fuſion. This is repeated three times ſucceſſively, at an interval of a quarter of an hour. After the third fire they uncover the furnace, and let the crucible cool; and at length break it, to get out the ſilver, which is found in a button or culot, the bottom of which is very fine ſilver; and the top mixed with the fæces of the ſalt-petre, and the alloy of the ſilver, and even ſome particles of fine ſilver. Then they ſeparate the culot from the impurities, and melt it in a new crucible; and throw charcoal-duſt into the diſſolution, and work the whole briſkly together. Then they cover the crucible up again, charge the furnace with coal, and give it a ſecond fire.

Having done this, they blow off the aſhes and impurities with bellows, from off the top of the metal, till it appears as clear as a looking-glaſs; and then they throw in an ounce of borax broken to pieces. Then, in the laſt place, they cover the crucible up again, and give it the laſt fire, and after this caſt it into ingots, which are found eleven penny weight and ſixteen grains fine. To recover the ſilver that may be left in the fæces and ſcoria, they pound them, and give them repeated lotions in freſh water.

REFINING of ſugar, ſulphur, camphor, &c. See SUGAR, CAMPHOR, &c.

REFLECTING, or REFLECTIVE DIAL. See DIALLING.

REFLECTION, or REFLEXION, in mechanics, the return or regreſſive motion of a moving body, occaſioned by ſome obſtacle which hindered it from purſuing its former direction.

REFLECTION, in catoptrics, is the return of a ray of light from the poliſhed ſurface of a ſpeculum or mirror.

The ray, thus returned, is called a reflex, or reflected ray, or ray of reflection; and the point of the ſpeculum, whence the return commences, the point of reflection.

Thus, the ray A B (plate CIX. *fig.* 2.) proceeding from the radiant A, and ſtriking on the point of the ſpeculum B, being returned thence to C; B C repreſents the reflected ray, and B the point of reflection; in reſpect whereof A B repreſents the incident ray, or ray of incidence, and B the point of incidence.

Again, a line, as C G, drawn from any point, as C, of the reflected ray B C, perpendicular to the ſpeculum, is called the cathetus of the reflection, or cathetus of the eye; as a line A F, drawn from the radiant, perpendicular to the ſpeculum, is called the cathetus of incidence.

Of the two angles which the reflected ray B C makes with the mirror, the ſmalleſt, C B E, is called the angle of reflection; as, of the two angles the incident ray makes with the ſpeculum, the ſmalleſt, A B D, is called the angle of incidence.

If the mirror be either concave or convex, the ſmalleſt angles the ray makes with a tangent to the point of reflection and incidence, are the angles of reflection and incidence.

The angle CBH, which the reflected ray makes with a perpendicular to the point of reflection, is called the inclination of the reflected ray; as the angle A B H is called the inclination of the incident ray.

General Rules of REFLECTION. — 1. If a ray of light be reflected from a ſpeculum of any form, the angle of incidence is ever equal to the angle of reflection. This law obtains in percuſſions of all kinds of bodies, and, conſequently, muſt do ſo in thoſe of light.

It might, therefore, be here aſſumed as an axiom; but it is of that importance, and its demonſtration ſo beautiful, that we cannot omit it. Suppoſe then D C (*fig.* 3.) an incident ray, propagated from the radiant A: Here, though the motion of the ray be ſimple, yet its determination in the line D C, being oblique with reſpect to the obſtacle, is really compounded of two determi-

terminations; the one along D E, the other along D G. The force along D C, therefore, is equal to the two forces along D G and D H; but the obſtacle G F only oppoſes one of the determinations, viz. that along D G (for it cannot oppoſe a determination parallel to itſelf, as D E;) therefore only the force along D G will be loſt by the ſtroke; that along D H or G C remaining entire. But a body perfectly elaſtic (ſuch as we ſuppoſe the ray of light) will recover, by its elaſticity, the force it loſt by the ſhock.

The ray, therefore, will recover the force D G or C H: thus, retaining both its forces, and both its former determinations, H C and C F, after percuſſion, it will be impelled along C F and C H, by the ſame forces as before along D H and D G, by its compound motion; therefore it will deſcribe the right line C E, and that in the ſame time as D C; and H E and D H will be equal, as being deſcribed by the ſame force. Now, the two triangles D C H and C H E are equal, and conſequently, their ſimilar angles equal; ſince then H C A = H C F; D C A, the angle of incidence, is equal to E C F, the angle of reflection. Q. E. D.

This law is confirmed in light by an eaſy experiment; for the ray of the ſun falling on a mirror in a dark room, through a little hole, you will have the pleaſure to ſee it rebound, ſo as to make the angle of reflection equal to that of incidence. The ſame may be ſhewn various other ways: thus, e. gr. placing a ſemi-circle F *i* G, (*fig.* 4.) on a mirror D E, its center on B, and its limb perpendicular to the ſpeculum; and aſſuming equal arches, F *a* and G *e*, place an object in A, and the eye in C, then will the object be ſeen by a ray reflected from the point B, and if B be covered, the object will ceaſe to be ſeen.

Hence, 1. If a ray of light, as H B, fall perpendicularly on the ſurface of a ſpeculum D E, it will be reflected back upon it.

2. From the ſame point of a ſpeculum ſeveral rays cannot be reflected to the ſame point; for in that caſe all the ſeveral angles of reflection would be equal to the ſame angle of incidence, which is abſurd.

3. One ray, as A B, cannot be reflected to two or more points; for in that caſe all its angles of reflection would be equal to the ſame angle of incidence; which is as abſurd as before.

2d. Each point of a ſpeculum reflects rays falling on it from each part of an object.

Hence, ſince ſeveral rays, coming from ſeveral parts of a radiant object, cannot be reflected from the ſame point of a ſpeculum to the ſame point; the rays that flow from different points of the object are ſeparate after reflection: and hence each ray ſhews the point whence it proceeded.

On this principle it is, that the rays reflected from mirrours or looking-glaſſes, exhibit the appearances of objects placed before them.

And hence we eaſily conceive, why rough bodies exhibit images, in regard they reflect the light in ſuch manner as to confound rays which proceed from different points, by means of their eminencies and cavities, their alternate riſings and fallings: But for this, all hard bodies would be mirrours.

3d. If the eye C and the radiant point A change places, the point will continue to radiate upon the eye, in the ſame courſe or path as before.

For if the object be removed from A to C, it will ſtill radiate on its former point of reflection B; but there can be but one right line drawn between the two points C and D, and the rays are right lines; therefore, that which was before the ray of reflection, will now be the ray of incidence; and, ſince it will be reflected under the ſame angle as that under which it fell, that which was before the ray of incidence, will now be the ray of reflection; ſo that the object, removed to C, will radiate on the eye, placed in A, by the right lines C D and B A.

Hence, an object is ſeen by the reflected ray A B, with the eye placed in A, the ſame as if the eye were in A C, and the object in A.

The truth of this theorem is ſo eaſily confirmed by experiment, that ſome, with Euclid, aſſume it as a principle, and demonſtrate the great law of reflection therefrom. Thus, ſuppoſe the angle of incidence a little greater than the angle of reflection, then will the angle A B F be greater than that C B E; wherefore, changing the places of the eye and the object, the angle C B E will become the angle of incidence; and, therefore, C B E greater than A B F, by the ſuppoſition; ſo that the ſame angle A B F will be greater and ſmaller than the other C B E; which, being allowed, A B E cannot be greater than C B E, and the ſame abſurdity will follow if it be ſuppoſed leſs, therefore it muſt be equal to the angle of reflection C B E.

4th. The plane of reflection, that is, the plane wherein the incident and reflected ray are found, is perpendicular to the ſurface of the ſpeculum, and in ſpherical ſpecula paſſes through the center.

5th. The image of an object ſeen in a mirror, is in the cathetus of incidence.

This holds good, univerſally, in plane and ſpherical mirrors, and uſually in concave ones, a few inſtances only excepted, as is ſhewn by Kepler. For the particular laws of reflection, ariſing from the circumſtances of the ſeveral kinds of ſpecula, or mirrors, plane, concave, convex, &c. ſee MIRROR.

REFLECTION is alſo uſed, figuratively, for an operation of the mind; whereby it turns its view backwards as it were upon itſelf, and makes itſelf and its own operation the object of its diſquiſition; and by contemplating the manner, order, and laws, which it obſerves in perceiving ideas, comparing them together, reaſoning, &c. it frames new ideas of the relations diſcovered therein.

REFLEX, or REFLECT, in painting, is underſtood of thoſe places in a picture which are ſuppoſed to be illuminated by a light reflected from ſome other body, repreſented in the ſame piece.

REFLEX VISION, that performed by means of reflected rays, as from mirrours.

REFLUX *of the Sea*, the ebbing of the water, or its returning from the ſhore. See TIDE.

REFORM, a re-eſtabliſhment, or revival of formerly neglected diſcipline, or a correction of the reigning abuſes therein.

To REFORM, in a military ſenſe, is to reduce a company, regiment, &c. either by diſbanding the whole, or breaking a part, and retaining the reſt.

REFORMADO, or REFORMED OFFICER, one whoſe troop, or company, is ſuppreſſed in a reform, and he continued either in the whole or half-pay, doing duty in the regiment.

REFORMATION, the act of reforming or correcting an error or abuſe in religion, diſcipline, or the like.

The Reformation, ſo called by way of eminence, is the ſeparation of the proteſtants from the church of Rome, in the beginning and towards the middle of the ſixteenth century. See LUTHERANS, &c.

REFRACTED, or REFRACTIVE DIAL, one that ſhews the hours by means of ſome refractive tranſparent fluid. See DIALLING.

REFRACTION, in mechanics, the deviation of a moving body from its direct courſe, by reaſon of the different denſity of the medium it moves in; or a flexion and change of direction, occaſioned by a body's falling obliquely out of one medium into another of a different denſity.

REFRACTION *of Light*, in optics, is an inflexion or deviation of the rays of light from their rectilinear courſe, upon falling obliquely out of one medium into another of a different denſity.

Whatever ſubſtance a ray of light paſſes through, or if it paſs through a ſpace void of all ſubſtance; it is ſaid, by philoſophers, to paſs through a medium; and, therefore, if it paſſes out of any ſubſtance, as in air or glaſs, into a vacuum, or the contrary, it is ſaid to paſs out of one medium into another.

All bodies being endued with an attractive force, which is extended to ſome diſtance beyond their ſurfaces; when a ray of light paſſes out of a rarer into a denſer medium, if this latter has a greater attractive force than the former, as is commonly the caſe, and what we ſhall hereafter always ſuppoſe, unleſs it be mentioned to the contrary, the ray, juſt before its entrance, will begin

gin to be attracted towards the denſer medium, and this attraction will continue to act upon it till ſome time after it has entered the medium, as we ſhall ſhew preſently; therefore, if a ray approaches a denſer medium in a direction perpendicular to its ſurface, its velocity will be continually accelerated during its paſſage through the ſpace in which that attraction exerts itſelf; and, therefore, after it has paſſed that ſpace, it will move on till it arrives at the oppoſite ſide of the medium, with a greater degree of velocity than it had before it entered. So that, in this caſe, its velocity only will be altered. Whereas, if a ray enters a denſer medium obliquely, it will not only have its velocity augmented thereby, but its direction will become leſs oblique to the ſurface, juſt as, when a ſtone is thrown downwards obliquely from a precipice, it falls to the ſurface of the ground in a direction nearer to a perpendicular one, than that with which it was thrown by the hand. From hence we ſee that a ray of light, in paſſing out of a rarer into a denſer medium, is refracted towards the perpendicular; that is, ſuppoſing a line drawn perpendicularly to the ſurface of the medium, through the point where the ray enters, and extended both ways, the ray in paſſing through the ſurface is refracted or bent towards the perpendicular line; or, which is the ſame thing, the line which it deſcribes by its motion after it has paſſed through the ſurface, makes a leſs angle with the perpendicular, than the line it deſcribed before. All which may be illuſtrated in the following manner.

Let us ſuppoſe, firſt, that the ray paſſes out of a vacuum into the denſer medium A B C D (plate CIX. *fig.* 5.) and that the attractive force of each particle in the medium is extended from its reſpective center to a diſtance equal to that which is between the lines A B and E F, or A B and G H, and let K L be the path deſcribed by the ray of light in its progreſs towards the denſer medium. This ray, when it arrives at L, will enter the attractive forces of thoſe particles which lie in A B, the ſurface of the denſer medium, and will therefore ceaſe to proceed any longer in the right line K L M, but will be diverted from its courſe by being attracted towards the line A B, and will begin to deſcribe the curve L N, paſſing through the ſurface A B in ſome new directions as O Q, thereby making a leſs angle with a line as P R drawn perpendicularly through the point N, than it would have done, had it proceeded in its firſt direction K L M.

Farther, whereas we have ſuppoſed the attractive force of each particle to be extended thro' a ſpace equal to the diſtance between A B and E F, it is evident the ray, after it has entered the ſurface, will ſtill be attracted downwards till it has arrived at the line E F; for, till that time, there will not be ſo many particles above it, which will attract it upwards, as below, that will attract it downwards. So that after it has entered the ſurface at N, in the direction O Q, it will not proceed in that direction, but will continue to deſcribe a curve, as N S, after which it will proceed ſtraight on towards the oppoſite ſide of the medium, being equally attracted every way; and, therefore, will at laſt proceed in the direction X S T, ſtill nearer the perpendicular P R than before.

Now if we ſuppoſe the ſpace A B Y Z not to be a vacuum, but a rarer medium than the other, the caſe will ſtill be the ſame; but the ray will not be ſo much refracted from its rectilineal courſe, becauſe, the attraction of the particles of the upper medium being in a contrary direction to that of the attraction of thoſe in the lower one, the attraction of the denſer medium will, in ſome meaſure, be deſtroyed by that of the rarer.

On the contrary, when a ray paſſes out of a denſer into a rarer medium, if its direction be perpendicular to the ſurface of the medium, it will only loſe ſomewhat of its velocity, in paſſing through the ſpace of attraction of that medium, that is, the ſpace wherein it is attracted more one way than it is another. If its direction be oblique, it will continually recede from the perpendicular during its paſſage, and by that means have its obliquity increaſed, juſt as a ſtone, thrown up obliquely from the ſurface of the earth, increaſes its obliquity all the time it riſes. Thus, ſuppoſing the ray T S paſſing out of the denſer medium A B C D into the rarer A B Y Z, when it arrives at S, it will begin to be attracted downwards, and ſo will deſcribe the curve S N L, and then proceed in the right line L K, making a larger angle with the perpendicular P R, than the line F S X, in which it proceeded during its paſſage through the other medium. The ſpace through which the attraction of coheſion of the particles of matter is extended is ſo very ſmall, that in conſidering the progreſs of a ray of light out of one medium into another, the curvature it deſcribes in paſſing through the ſpace of attraction is generally neglected, and its path is ſuppoſed to be bent, or, in the uſual terms, the ray is ſuppoſed to be refracted only in the point where it enters the denſer medium.

Now the ray which a line deſcribes, before it enters a denſer or rarer medium, is called the incident ray; that which it deſcribes after it has entered, is the refracted ray.

The angle comprehended between the incident ray and the perpendicular, is the angle of incidence; and that between the refracted ray and the perpendicular, is the angle of refraction.

There is a certain and immutable law or rule, by which refraction is always performed, and that is this; whatever inclination a ray of light has to the ſurface of any medium before it enters it, the degree of refraction will always be ſuch, that the proportion between the ſine of the angle of its incidence, and that of the angle of its reflection, will always be the ſame in that medium.

To illuſtrate this, let us ſuppoſe A B C D (*fig.* 6.) to repreſent a rarer, and A B E F a denſer medium; let G H be a ray of light paſſing through the firſt, and entering the ſecond at H, and let H I be the refracted ray; then ſuppoſing the perpendicular P R drawn through the point H, on the center H, and with any radius deſcribe the circle A P B R, and from G and I, where the incident and refracted rays cut the circle, let fall the lines G K and I L perpendicularly upon the line P R, the former of theſe will be the ſine of the angle of incidence, the latter of refraction. Now, if, in this caſe, the ray G H is ſo refracted at H, that G K is double or treble, &c. of I L, then, whatever other inclination the ray G H might have had, the ſine of its angle of incidence would have been double or treble, &c. to that of its angle of refraction. For inſtance, had the ray paſſed in the line M H before refraction, it would have paſſed in ſome line, as H N afterwards, ſo ſituated, that M O ſhould have been double or treble, &c. of N Q.

When a ray paſſes out of a vacuum into air, the ſine of the angle of incidence is found to be to that of refraction, as 100036 to 100000.

When it paſſes out of air into water, as about 4 to 3.

When out of air into glaſs, as about 17 to 11.

When out of air into a diamond, as about 5 to 2.

REFRACTION, in aſtronomy, is an inflection of the rays of light iſſuing from a heavenly body, in paſſing through the atmoſphere of the earth, whereby the apparent altitude of it is increaſed.

If we imagine the atmoſphere to be divided into any number of concentric ſpherical ſpaces of different diſtances, for example, into four, as is done in plate CIX. *fig.* 7. by a like number of ſpherical ſurfaces, a ray of light coming from a ſtar at A, would proceed in a ſtraight line till it falls upon the outward ſurface at B; there it would be a little bent, and go on from thence in a ſtraight line to C, where falling upon a ſurface of thicker air, it would receive a greater refraction, and go on in the ſtraight line C D; at D, ſtill thicker air would give it a new and greater refraction, into the line D E; at E the air being more denſe, would give it the greateſt refraction, into the line E F: As all viſion is made in a right line, a ſpectator upon the earth at F would ſee the ſtar in the line F E continued; ſo that its refracted or apparent place is G, higher or nearer to the zenith than its true place A: refraction, therefore, makes all the heavenly bodies appear higher than their true places.

If, inſtead of four, we imagine the atmoſphere to be divided into an infinite number of ſpherical ſpaces, containing air of different denſities, it is eaſy to ſee, that

inſtead of going into four ſeveral ſtraight lines, a ray of light paſſing through the atmoſphere, will go in a curve line, whoſe curvature continually increaſes till it falls upon the earth, as is repreſented by the curve A B C D, *fig.* 8.

If a ſtar be in the zenith of a ſpectator upon the earth, a ray, coming from it to his eye, falls perpendicularly upon the ſpherical ſurface of the atmoſphere, and will, therefore, proceed in a ſtraight line, without being refracted. If a ſtar be in the horizon of an obſerver, a ray, coming from it to his eye, ſuffers the greateſt refraction of all, for two reaſons; 1ſt, The ray falls upon the ſurface of the atmoſphere with the greateſt obliquity. 2dly, It paſſes through the largeſt ſpace of the lower and denſer part of the air; thus, let A B C, (plate CIX. *fig.* 9) be part of the ſurface of the earth, B the place of an obſerver; if a ſtar be in the zenith at Z, the line Z B, drawn from the ſtar to the eye, falls perpendicular upon the ſpherical ſurface of the atmoſphere at F, and, conſequently, will be perpendicular to all the concentric ſpherical ſurfaces which we can imagine in the atmoſphere: If a ſtar be in his horizon at G, the ray G D, by which the ſtar is ſeen, falls more obliquely upon the atmoſphere at D, than the ray H E from a ſtar at H does at E; or than a ray coming from any ſtar between G and Z to the eye at B; moreover, the line D B is longer than F B, or E B, or than any other line which can be drawn from the outſide of the atmoſphere to the eye at B, between D B and F B.

The refractions of the heavenly bodies, as the ſun, moon, and ſtars, at all altitudes except very ſmall ones, will be nearly as the tangents of their apparent zenith diſtances, drawn into the reſpective denſity of the atmoſphere at the places and times for which ſuch refractions are to be determined; and therefore, if the denſity be the ſame, are ſimply as the tangent of their apparent zenith diſtances. But at very ſmall altitudes the refractions may be found by this general rule:

As 1 to 9986, ſo is the ſine of any given apparent zenith diſtance, to the ſine of an arch; $\frac{2}{11}$ of the difference of which arch and the given zenith diſtance is the refraction ſought, which for an altitude of 5°, will come out 9′ 10″; and in this manner were the two following tables computed by the late Mr. Thomas Simpſon, founded upon numbers which were deduced from obſervations communicated to the author by Dr. Bevis; the firſt adapted to the mean denſity of the atmoſphere, and the other to ſerve when the refractions are the greater.

Ap. Alt.	Refract.		Ap. Alt.	Refract.		Ap. Alt.	Refract.		Ap. Alt.	Refract.	
°	′	″	°	′	″	°	′	″	°	′	″
0	33	30	25	1	52	0	35	30	25	1	58
1	23	50	26	1	47	1	25	30	26	1	53
2	17	43	27	1	42	2	18	51	27	1	48
3	13	44	28	1	38	3	14	36	28	1	43
4	11	05	29	1	34	4	11	43	29	1	39
5	9	10	30	1	30	5	9	44	30	1	35
6	7	49	32	1	23	6	8	18	32	1	28
7	6	48	34	1	17	7	7	12	34	1	22
8	5	59	36	1	12	8	6	20	36	1	16
9	5	21	38	1	07	9	5	39	38	1	11
10	4	50	40	1	02	10	5	07	40	1	06
11	4	24	42	0	58	11	4	40	42	1	01
12	4	02	44	0	54	12	4	16	44	0	57
13	3	43	46	0	50	13	3	56	46	0	53
14	3	27	48	0	47	14	3	39	48	0	49
15	3	13	50	0	44	15	3	24	50	0	46
16	3	01	52	0	41	16	3	11	52	0	43
17	2	50	54	0	38	17	2	59	54	0	40
18	2	40	56	0	35	18	2	48	56	0	37
19	2	31	58	0	32	19	2	39	58	0	34
20	2	23	60	0	30	20	2	31	60	0	32
21	2	16	65	0	24	21	2	23	65	0	26
22	2	09	70	0	19	22	2	16	70	0	20
23	2	03	75	0	14	23	2	09	75	0	15
24	1	57	80	0	9	24	2	03	80	0	10

REFRACTION *of Altitude* is an arch of a vertical circle, whereby the altitude is increaſed by the refraction.

REFRACTION *of Declination* is an arch of a circle of declination, whereby the declination of the object is either increaſed or diminiſhed by the refraction.

REFRACTION *of Longitude* is an arch of the ecliptic, whereby the longitude of the object is increaſed or diminiſhed by the refraction.

REFRACTION *of Latitude* is an arch of a circle of latitude, whereby the latitude of a heavenly object is either increaſed or diminiſhed by its refraction.

REFRACTION *in Iſland Cryſtal.* There is a double refraction in this ſubſtance, contrary ways, whereby not only oblique rays are divided into two, and refracted into oppoſite parts, but even perpendicular rays, and one half refracted.

REFRIGERATIVE, in medicine, a remedy which refreſhes the inward parts, by cooling them, as clyſters, ptiſans, &c.

REFRIGERATORY, in chemiſtry, a veſſel filled with cold water, through which the worm paſſes in diſtillations; the uſe of which is, to condenſe the vapours as they paſs through the worm.

REFUGE, a ſanctuary or aſylum.

REFUGEES, French Proteſtants, who by the revocation of the edict of Nantz, have been conſtrained to fly from perſecution, and take refuge in foreign countries.

REGAL, or ROYAL, ſomething belonging to a king. See ROYAL.

REGALIA, in law, the rights and prerogatives of a king; which, according to civilians, are ſix, viz. 1. the power of judicature: 2. the power of life and death: 3. the power of peace and war: 4. a right to ſuch goods as have no owner, as waifs, eſtrays, &c. 5. aſſeſſments; and 6. the coinage of money.

REGALIA is alſo uſed for the apparatus of a coronation, as the crown, the ſceptre with the croſs, that with the dove, St. Edward's ſtaff, the globe, and the orb with the croſs, four ſeveral ſwords, &c.

REGALIA *of the Church*, are the rights and privileges which cathedrals, &c. enjoy by the grants of kings; and this term is particularly uſed for ſuch lands and hereditaments as have been given by kings to the church.

REGARD *of the Foreſt*, the inſpection or overſight thereof, or the office and province of the regarder. See REGARDER.

REGARDANT, in heraldry, ſignifies looking behind, and is uſed for a lion, or other beaſt, with his face turned towards his tail.

REGENERATION, in theology, the act of being born again by a ſpiritual birth, or the change of heart and life, experienced by a perſon who forſakes a courſe of vice, and ſincerely embraces a life of virtue and piety.

REGENT, one who governs a kingdom during the minority or abſence of the king.

REGICIDE, KING-KILLER, a word chiefly uſed with us in ſpeaking of the perſons concerned in the trial, condemnation, and execution of king Charles I.

REGIMEN, the regulation of diet, and in a more general ſenſe, of all the non-naturals, with a view to preſerve or reſtore health.

Dr. Mead obſerves, with reſpect to regimen, that diſeaſes from inanition are generally more dangerous than thoſe which proceed from repletion, becauſe we can more expeditiouſly diminiſh than increaſe the juices of the body. Upon this account, though temperance is beneficial to all men, the ancient phyſicians adviſed perſons in good health to indulge a little now and then, by eating and drinking more plentifully than uſual: but of the two, intemperance in drinking is ſafer than in eating; and if a perſon has committed exceſs in the latter, cold water drank upon a full ſtomach will help digeſtion; to which it will be of ſervice to add lemon-juice or elixir of vitriol, if he has eaten high ſeaſoned things, rich ſauces, &c. Then let him ſit up for ſome time, and afterwards ſleep. But if a man happens to be obliged to faſt, he ought to avoid all laborious work. From ſatiety it is not proper to paſs directly to ſharp hunger, nor from hunger to ſatiety; neither will it be ſafe to indulge abſolute reſt immediately after exceſſive labour, nor ſuddenly to fall to hard work after

after long idleneſs. In a word, all changes in the way of living ſhould be made by degrees. It is alſo beneficial to vary the ſcenes of life, to be ſometimes in the country, ſometimes in town; to go to ſea, to hunt, to be at reſt now and then, but more frequently to uſe exerciſe, and a moderate ſleep.

The ſofter and milder kinds of aliment are proper for children, and for youths the ſtronger. Old people ought to leſſen the quantity of their food, and increaſe that of their drink. But yet ſome allowance is to be made for cuſtom, eſpecially in the colder climates, like ours; for as in theſe the appetite is keener, ſo is the digeſtion better performed.

In the ſummer, ſays Dr. Brookes, when the ſpirits and fluid parts are apt to evaporate, the aliment ſhould be light, moiſt, fluid, and eaſy of digeſtion, to repair the loſs with the greater ſpeed: and as digeſtion depends in part on the due preparation of the aliments, it is neceſſary to chew them well, eſpecially if they are hard, that they may be the more intimately mixed with the ſaliva; for thoſe who eat in a hurry, without much chewing, are very ſubject to indigeſtions.

It is well known, the cold ſtops the pores, and diminiſhes perſpiration. To ſhun this inconvenience, it will be neceſſary to put on winter garments pretty early, and to leave them off late, and not to paſs too ſuddenly from a hot into a cold air, and to avoid drinking any thing cold, when the body is hot, or when a perſon has been for ſome time ſpeaking in public.

In ſhort, the paſſions and affections of the mind produce very ſenſible effects. Joy, anger, fear, and ſorrow, are the principal. In the firſt, the ſpirits are hurried with too great vivacity; in fear or dread, they are as it were, curbed and concentrated; and continual ſorrow and anguiſh of mind render the fluids of the body thick, and the blood unapt for a due circulation, whence proceed many chronic diſeaſes: it is therefore, on all accounts, as much our intereſt as our duty, to keep the paſſions within due bounds, and to preſerve an inward ſerenity, calmneſs and tranquility.

REGIMEN, in chemiſtry, ſignifies the due regulation of fire. See FIRE.

REGIMEN, in grammar, that part of ſyntax, or conſtruction, which regulates the dependency of words, and the alterations which one occaſions in another.

REGIMENT, in war, is a body of men, either horſe or foot, commanded by a colonel.

REGION, in geography, a large extent of land, inhabited by many people of the ſame nation, and incloſed within certain limits or bounds.

REGION, in phyſiology, is taken for a diviſion of our atmoſphere, which is divided into the upper, middle, and lower regions. See ATMOSPHERE.

Æthereal REGION, in coſmography, is the whole extent of the univerſe, in which is included all the heavenly bodies, and even the orb of the fixed ſtars. See the article ÆTHER.

Elementary REGION, according to the Ariſtotelians, is a ſphere terminated by the concavity of the moon's orb, comprehending the atmoſphere of the earth.

REGION, in anatomy, a diviſion of the human body, otherwiſe called cavity, of which anatomiſts reckon three, viz. the upper region, or that of the head; the middle region, that of the thorax or breaſt; and the lower, the abdomen, or belly.

REGISTER, a public book, in which is entered and recorded memoirs, acts, and minutes, to be had recourſe to occaſionally, for knowing and proving matters of fact.

REGISTER is alſo uſed for the clerk or keeper of a regiſter.

REGISTER, in printing, is diſpoſing of the forms on the preſs, ſo as that the lines and pages printed on one ſide of the ſheet, fall exactly on thoſe of the other.

REGISTER, among letter-founders, is one of the inner parts of the mould, in which the printing-types are caſt.

REGISTERS, in chemiſtry, are holes, or chinks with ſtopples, contrived in the ſides of furnaces, to regulate the fire; that is, to make the heat more intenſe, or remiſs, by opening them to let in the air, or keeping them cloſe to exclude it.

REGLET, or RIGLET, in architecture, a flat narrow moulding, uſed chiefly in pannels and compartiments, to ſeparate the parts or members from one another, and to form knots, frets, and other ornaments.

REGLETS, or RIGLETS, in printing, are thin ſlips of wood, exactly planed to the ſize of the body of the letter.

REGRATOR, or REGRATER, in law, formerly ſignified one who bought wholeſale, or by the great, and ſold again by retail: but the term is now uſed for one who buys any wares or victuals, and ſells them again in the ſame market, or fair, or within five miles round it.

REGULAR, the relation of any thing conformable to the rules of art.

REGULAR *Figure*, in geometry, a figure both equilateral and equiangular.

REGULAR, or *Platonic Body*, a ſolid terminated on all ſides by regular, ſimilar, and equal planes, and whoſe ſolid angles are all equal. The ſolid bodies are the five following: 1. The tetrahedron, which is a pyramid, comprehended under four equal and equilateral triangles. 2. The hexahedron, or cube, whoſe ſurface is compoſed of ſix equal ſquares. 3. The octahedron, which is bounded by eight equal and equilateral triangles. 4. The dodecahedron, which is contained under twelve equal and equilateral pentagons. 5. The icoſihedron, conſiſting of twenty equal and equilateral triangles. Theſe five are all the regular bodies in nature.

The proportion of the five regular bodies inſcribed in the ſame circle from Peter Aerigon. Curſus Math. vol. I. p. 779. and Barrow's Euclid, lib. XIII.

The diameter of the ſphere being 2.

The circumference of the greateſt circle	6.28318
Superficies of the greateſt circle	3.14159
Superficies of the ſphere	12.56637
Solidity of the ſphere	4.1879
Side of the tetrahedron	1.62299
Superficies of a tetrahedron	4.6188
Solidity of a tetrahedron	0.15132
Side of a cube or hexahedron	1.1547
Superficies of the hexahedron	8.
Solidity of the hexahedron	1.5366
Side of an octahedron	1.41421
Superficies of the octahedron	6.9282
Solidity of the octahedron	1.33333
Side of the dodecahedron	0.71364
Superficies of the dodecahedron	10.51462
Solidity of the dodecahedron	2.78516
Side of the icoſihedron	1.05146
Superficies of the icoſihedron	9.57454
Solidity of the icoſihedron	2.53615

If one of theſe five regular bodies were required to be cut out of the ſphere of any other diameter, it will be as the diameter of the ſphere 2 is to the ſide of any one ſolid inſcribed in the ſame (ſuppoſe the cube 1.1547) ſo is the diameter of any other ſphere (ſuppoſe 8) to 9.2376, the ſide of the cube inſcribed in this latter ſphere.

Let dr (plate CIX. *fig.* 10.) be the diameter of any ſphere, and $da \frac{1}{3}$ of it $= ab = br$. Erect the perpendiculars ae, ef, and bg, and draw de, df, er, fr, and gr. Then will

1. re be as the ſide of the tetrahedron.
2. df is the ſide of the hexahedron.
3. de is the ſide of the octahedron.
4. Cut de in extreme and mean proportion in h, and dh will be the ſide of the dodecahedron.
5. Set the diameter dr up, perpendicularly, at r, and from the center c, to its top, draw the line cg, cutting the circle in g. Let fall the perpendicular gb; then is br the ſide of the icoſihedron.

REGULAR *Curves*, ſuch as proceed gradually in the ſame geometrical manner, with regard to their curvities.

REGULAR, in a monaſtery, a perſon who has taken the vows.

REGULAR *Prieſt*, a prieſt in ſome religious order; in contradiſtinction to a ſecular prieſt, or one that lives in the world at large.

REGULATOR *of a watch*, the ſmall ſpring belonging to the ballance; ſerving to adjuſt its motions, and make it go faſter or ſlower.

REGULUS, in chemiſtry, an imperfect metallic ſubſtance, that falls to the bottom of the crucible, in the melting of ores, or impure metallic ſubſtances.

REGULUS, in aſtronomy, a ſtar of the firſt magnitude, in the conſtellation Leo, called alſo from its ſituation, *cor leonis*, or the lion's heart. See LEO.

REHEARSAL, in muſic, and the drama, an eſſay or experiment of ſome compoſition generally made in private, previous to its repreſentation or performance in public, in order to render the actors and performers more perfect in their parts.

REIMBURSEMENT, in commerce, the act of repaying another the expences he has been at on our account.

REIN-DEER, in zoology, a ſpecies of the cervus, with horns ramoſe and cylindric, with their tops palmated.

This is a large and beautiful ſpecies, not inferior to the elk in ſize or ſtrength, but greatly exceeding it in form; it is of the ſize of a ſmall horſe, but its ſhape is exactly that of the red-deer. It is a native of the northern regions, there being no country ſo far north as not to afford it, where it is of vaſt uſe to the inhabitants, as a beaſt of draught.

REINFORCED, or REINFORCED RING, of a cannon, is the next after the trunnions, betwixt them and the touch-hole.

REINFORCEMENT, in war, a freſh ſupply of men, arms, ammunition, &c.

REINS, in anatomy, the ſame with the kidneys. See KIDNEYS.

REJOINTING, in architecture, filling up the joints of the ſtones in buildings.

REJOYNDER, or REJOINDER, in law, is the defendant's anſwer to the plaintiff's replication or reply.

RELAPSE, a falling again into a danger, evil, or diſeaſe, from which a perſon has eſcaped.

RELATION, *Relatio*, in philoſophy, the mutual reſpect of two things, or what each is with regard to the other.

Relations make the largeſt claſs of our perceptions, ſince every ſingle object admits of almoſt innumerable compariſons with others: thus, if we compare one thing with another in reſpect of bulk, we get the ideas of greater, leſs, or equality; if in reſpect of time, of older and younger; and ſo for other relations, which we can purſue at pleaſure, almoſt without end; whence it is eaſy to conceive, how very extenſive this tribe of our perceptions muſt be. However, here, as well as in the other kinds of our complex ideas, we bound ourſelves for the moſt part to ſuch compariſons, as the exigencies of ſociety, the wants of life, and the different profeſſions of men render neceſſary; and are more or leſs accurate in tracing out the relations of things, according to the degree of importance they appear to have in theſe reſpects. The relations of men one to another, ariſing either from the ties of blood, their ſeveral ranks and places in the community, or a mutual intercourſe of good offices, being of great weight and concern in the commerce of life, have in a particular manner engaged our attention, and are therefore very minutely deſcribed. For the ſame reaſon men have found it neceſſary to determine as exactly as poſſible, the various dependence of things, as their happineſs is nearly connected with this knowledge. When we conſider objects merely in reſpect of exiſtence, as either giving or receiving it, we come by the relative ideas of cauſe and effect, which are very nearly connected with the welfare of mankind; it being evident, that the ſeveral ſchemes and purpoſes of life are all conducted upon a previous ſuppoſition, that certain known cauſes will have their uſual regular effects, and ſuch and ſuch actions be attended with ſuch and ſuch conſequences.

But there are other relations of this kind, as when we alſo take in the additional gifts of a capacity for happineſs, and the means of attaining it; which conſtitutes the relation of creator and creature, in the more ſolemn acceptation of theſe words. Again, when we conſider the great Author of our being, not only as the creator of the univerſe, but alſo as preſerving and holding it together, and preſiding over the preſent frame of things with uncontrouled dominion; he then appears under the notion of a moral governor, to whom we are accountable for our actions, and the uſe we make of thoſe powers and faculties we derive from him. And thus we may, in ſome meaſure, perceive, how the mind proceeds in comparing its ideas together, and by what views it is chiefly governed in framing the compound notions of this claſs, by which it repreſents the various habitudes of things.

Moral actions are nothing but relations, it being their conformity or diſagreement with ſome rule that makes them either good or bad, or indifferent; and indeed, we ought carefully to diſtinguiſh between the poſitive idea of the action, and the reference it has to a rule.

RELATION, in geometry, ſignifies the ſame with ratio.

RELATION, in grammar, is the correſpondence which words have to one another in conſtruction.

RELATIVE, ſomething relating to, or reſpecting, another.

RELATIVE TERMS, in logic, are words which imply a relation: ſuch as maſter and ſervant, huſband and wife, &c.

RELAY, a ſupply of horſes placed on the road, and appointed to be ready for a traveller to change, in order to make the greater expedition.

RELAY, in tapeſtry, is an opening left, where the colours and figures are to be changed, when the piece is finiſhed.

RELEASE, in law, is an inſtrument in writing by which eſtates, rights, titles, entries, actions, and other things are extinguiſhed and diſcharged; and ſometimes transferred, abridged, or enlarged: and, in general, it ſignifies one perſon's giving up or diſcharging the right or action he has, or claims to have, againſt another, or his lands, &c.

RELEGATION, a kind of baniſhment or exile, in which a perſon is ſentenced to retire to a certain place preſcribed, and to continue there a certain time, or till he is recalled.

RELICS, in the Romiſh church, the remains of the bodies or cloaths of ſaints or martyrs, and the inſtruments by which they were put to death, devoutly preſerved, in honour to their memory; kiſſed, revered, and carried in proceſſion.

RELICT, in law, the ſame with widow. See the article WIDOW.

RELIEVE, in a military ſenſe, is to ſend off thoſe men that are upon duty, and to bring others to take their place: thus, to relieve the guard, the trenches, &c. is to bring freſh men upon duty, and to diſcharge thoſe who were upon duty before.

RELIEVING-TACKLES, in naval affairs, two ſtrong purchaſes paſſing under the bottom of a ſhip when ſhe is laid on a careen, to bring her upright again, when it may be difficult to right her without them. They are paſſed under the keel, and faſtened to the upper part of the oppoſite ſide, or the ſide fartheſt from the ſhore, or wharf, where the careen tackles are faſtened.

RELIEVO, or RELIEF, in ſculpture, &c. is the projecture or ſtanding out of a figure, which ariſes prominent from the ground or plan on which it is formed; whether that figure be cut with the chiſſel, moulded or caſt.

There are three kinds or degrees of relievo, viz. alto, baſſo, and demi-relievo. The alto-relievo, called alſo haut-relief or high relievo, is when the figure is formed after nature, and projects as much as the life. Baſſo-relievo, baſs-relief, or low-relievo, is when the work is raiſed but a little from the ground, as in medals, and the frontiſpieces of buildings; and particularly in the hiſtories, feſtoons, foliages, and other ornaments of friezes. Demi-relievo is when one-half of the figure riſes from the plan. When, in a baſſo-relievo, there are parts that ſtand clear out, detached from the reſt, the work is called demi baſſo.

In architecture, the relievo or projecture of the ornaments, ought always to be proportioned to the magnitude

tude of the building it adorns, and to the diſtance at which it is to be viewed.

RELIEVO, or RELIEF, in painting, is the degree of boldneſs with which the figures ſeem, at a due diſtance, to ſtand out from the ground of the painting.

RELIGION, that worſhip and homage which is due to God, conſidered as our creator, preſerver, and moſt bountiful benefactor.

As our affections depend on our opinions of their objects, it ſeems to be among the firſt duties we owe to the Author of our being, to form the leaſt imperfect, ſince we cannot form perfect, conceptions of his character and adminiſtration: for ſuch conceptions will render our religion rational, and our diſpoſitions refined. If our opinions are diminutive and diſtorted, our religion will be ſuperſtitious, and our temper abject. Thus, if we aſcribe to the Deity that falſe majeſty, which conſiſts in the unbenevolent and ſullen exerciſe of mere will or power, or ſuppoſe him to delight in the proſtrations of ſervile fear, or as ſervile praiſe, he will be worſhipped with mean adulation, and a profuſion of compliments. If he be looked upon as a ſtern and implacable being, delighting in vengeance, he will be adored with pompous offerings, or whatever elſe may be thought proper to ſooth and mollify him. But if we believe perfect goodneſs to be the character of the Supreme Being, and that he loves thoſe who reſemble him moſt, in this, the moſt amiable of his attributes, the worſhip paid him will be rational and ſublime, and his worſhippers will ſeek to pleaſe him by imitating that goodneſs which they adore. Indeed, wherever right conceptions of the Deity, and his providence, prevail, when he is conſidered as the inexhauſted ſource of light, and love, and joy, as acting in the joint character of a father and governor, what veneration and gratitude muſt ſuch conceptions, thoroughly believed, excite in the mind? how natural and delightful muſt it be, to one whoſe heart is open to the perception of truth, and of every thing fair, great, and wonderful in nature, to engage in the exerciſes of religion, and to contemplate and adore him, who is the firſt fair, firſt great, and firſt wonderful; in whom wiſdom, power, and goodneſs dwell vitally, eſſentially, and act in perfect concert? what grandeur is here, to fill the moſt enlarged capacity; what beauty to engage the moſt ardent love; what a maſs of wonders, in ſuch exuberance of perfection, to aſtoniſh and delight the human mind, through an unfailing duration! When we conſider the unſullied purity, and abſolute perfection of the divine nature; and reflect on the imperfection and various blemiſhes of our own, and the ungrateful returns we have made to his goodneſs, we muſt ſink, or be convinced we ought to ſink, into the deepeſt humility and proſtration of ſoul before him, and be conſcious that it is our duty to repent of a temper and conduct ſo unworthy of our nature, and ſo unbecoming our obligations to its author; and to reſolve and endeavour to act a wiſer and a better part for the future. And if the Deity is conſidered as the father of mercies, who loves his creatures with infinite tenderneſs, and, in a particular manner, all good men; nay, who delights in goodneſs even in its moſt imperfect degrees; what reſignation, what dependence, what generous confidence, what hope in God, and in his all-wiſe providence, muſt ariſe in the ſoul that is poſſeſſed of ſuch amiable views of him. We muſt farther obſerve, that all thoſe affections which regard the Deity as their immediate and primary object, are vital energies of the ſoul, and conſequently exert themſelves into act, and, like all other energies, gain ſtrength or greater activity by that exertion: it is therefore our duty, as well as higheſt intereſt, often, at ſtated times, and by decent and ſolemn acts, to adore the great original of our exiſtence, to expreſs our veneration and love by a devout recognition of his perfections, and to evidence our gratitude by celebrating his goodneſs, and thankfully acknowledging all his benefits; by proper exerciſes of ſorrow and humiliation to confeſs our ingratitude and folly, to ſignify our dependence on God, our confidence in his goodneſs; and our reſignation to the diſpoſals of his providence, and this not only in private, but in public worſhip, where the preſence of our fellow-creatures, and the powerful contagion of the ſocial affections, conſpire to kindle and ſpread the devout flame with greater warmth and energy.

Religion is divided into natural and revealed. By natural religion is meant that knowledge, veneration, and love of God, and the practice of thoſe duties to him, our fellow-creatures, and ourſelves, which are diſcoverable by the right exerciſe of our rational faculties, from conſidering the nature and perfections of God, and our relation to him and to one another. See ETHICS.

And by revealed religion is meant, natural religion explained, enforced, and enlarged, from the expreſs declarations of God himſelf, from the mouths or pens of his prophets, &c.

Religion, in a more contracted ſenſe, is uſed for that ſyſtem of faith and worſhip, which obtains in ſeveral countries of the world; and even for the various ſects into which each religion is divided.

RELIGIOUS, in popiſh countries, is particularly uſed for a perſon engaged, by ſolemn vows, to the monaſtic life: or a perſon ſhut up in a monaſtery, to lead a life of devotion and auſterity, under ſome rule or inſtitution.

RELIQUARY, a ſhrine or caſket, wherein the relics of a dead ſaint are kept.

REMAINDER, in law, is an eſtate in lands, tenements, or rents, not to be enjoyed till after a term of years, or another perſon's deceaſe: thus, a perſon grants lands or tenements to one perſon, for a term of years, or for life, and the remainder to another perſon for life, or in fee.

REMAINDER, in mathematics, is what is left after taking a leſſer number out of a greater.

REMEDY, in medicine, a preparation applied either internally or externally, for the cure of a diſeaſe.

REMINISCENCE, *Reminiſcentia*, that power of the human mind, whereby it recollects itſelf, or calls again into its remembrance ſuch ideas or notions as it had really forgot: in which it differs from memory, which is a treaſuring up of things in the mind, and keeping them there, without forgetting them.

REMISSION, in phyſics, the abatement of the power, or efficacy of any quality, in oppoſition to the increaſe of the ſame, which is called intenſion.

REMISSION, in medicine, is when a diſtemper abates, but does not go quite off before it returns again, as is common in fevers, which do not quite intermit.

REMITTANCE, in commerce, the traffic or return of money from one place to another, by bills of exchange, orders, or the like.

This word is alſo uſed in ſpeaking of the payment of a bill of exchange. It alſo ſignifies the fee or reward given a banker, both of his wages and the different value of the ſpecies in the places where you pay the money, and where he remits it.

REMITTER, in law. Where a perſon has two titles to lands, &c. and he comes to ſuch lands by the laſt title, which proving defective, he ſhall be reſtored to, and adjudged in, by virtue of his former more antient title, this is called remitter.

REMONSTRANCE, an expoſtulation or humble ſupplication, addreſſed to a king, or other ſuperior, beſeeching him to reflect on the inconveniences, or ill conſequences of ſome order, edict, or the like.

REMORA, the ſuck-fiſh, in ichthyology, a ſingular fiſh which grows to about nine inches in length, and more than two in diameter in the largeſt part of the body, which is near the head, whence it becomes gradually ſmaller to the tail; the back is convex, the belly flat, and the ſides are rounded by means of the ſtructure of its head. This fiſh applies itſelf firmly to any ſolid body that it pleaſes; and is frequently found ſticking to the bottom of ſhips, and often to large fiſh.

REMOUNT, in war. To remount the cavalry, is to furniſh troopers or dragoons with freſh horſes, inſtead of ſuch as have been killed or diſabled in the ſervice.

RENAL, ſomething belonging to the reins or kidneys. See KIDNEYS.

RENCOUNTER, in the military art, an engagement of two little bodies or parties of forces; in which ſenſe it ſtands in oppoſition to a pitched battle.

RENCOUNTRE, or RECONTRE, in heraldry, is applied to animals when they ſhew their head in front, with

with both eyes, &c. or when the face ſtands right forward, as if they came to meet the perſon before them.

RENDERING, in ſea affairs, ſliding or yielding through any place, as in the ſeveral holes, or channels, of the blocks of a tackle. When all the parts yield, or draw, without interruption, they are ſaid to render.

RENDEZVOUS, or RENDEVOUS, a place appointed to meet in, at a certain day and hour.

RENIFORM, ſomething reſembling the figure or ſhape of the kidneys. See KIDNEY.

RENITENCY, *renitentia*, among philoſophers, that force in ſolid bodies, whereby they reſiſt the impulſe of other bodies, or re-act as much as they are acted on.

RENT, *reditus*, in law, a ſum of money, or other conſideration, iſſuing yearly out of lands or tenements.

RENTAL, ſignifies a roll in which the rents of manors are ſet down, in order for the lord's bailiff thereby to collect the ſame. It contains the lands let to each tenant, with their names, and the ſeveral rents ariſing.

RENTERING, in the manufactories, the ſame with fine-drawing.

RENVERSE', in heraldry, is when any thing is ſet with the head downwards, or contrary to its natural way of ſtanding. Thus, a chevron renverſé, is a chevron with the point downwards. They uſe alſo the ſame term when a beaſt is laid on its back.

RENUENTES, in anatomy, a pair of muſcles of the head, thus called as being antagoniſts to the annuentes, and ſerving to throw the head backwards.

RENUNCIATION, *renunciatio*, the act of renouncing, abdicating, or relinquiſhing any right, real or pretended.

REPAIRING, or REPARATION, *reparatio*, the act of retrieving, mending, or eſtabliſhing a building, or other work, damaged or gone to decay.

REPARTEE, or REPARTY, a ready ſmart reply, eſpecially in matters of wit, humour, or raillery.

REPARTITION, a dividing or ſharing a thing a ſecond time.

REPEALING, in law, the revoking or annulling of a ſtatute, or the like.

REPEAT, in muſic, a character ſhewing that what was laſt played or ſung muſt be repeated, or gone over again.

REPELLANTS, in medicine, remedies which drive back a morbid humour into the maſs of blood, from which it was unduly ſecreted.

REPERCUSSION, in mechanics. See the article REFLECTION.

REPERCUSSION, in muſic, a frequent repetition of the ſame ſound.

REPERTORY, *Repertorium*, a place wherein things are orderly diſpoſed, ſo as to be eaſily found when wanted. The indices of books are repertories, ſhewing where the matters ſought for are treated of. Common-place books are alſo kinds of repertories.

REPETITION, in muſic, denotes reiterating, or playing over-again, the ſame part of a compoſition, whether it be a whole ſtrain, part of a ſtrain, or double ſtrain, &c.

REPETITION, in rhetoric, a figure which gracefully and emphatically repeats either the ſame word, or the ſame ſenſe in different words.

REPLANTING, in gardening, the act of planting a ſecond time. See PLANTING.

REPLETION, in medicine, a plenitude or plethora. See PLETHORA.

Repletion is more dangerous than inanition. Bleeding and diet are the great reſources when a perſon is incommoded with a repletion.

Repletion is ſometimes alſo uſed where the ſtomach is overloaden with too much eating or drinking. The phyſicians hold all repletion to be prejudicial, but that of bread is of all others the worſt.

REPLETION, in the canon law, is where the revenue of a benefice or benefices is ſufficient to fill or occupy the whole right or title of the graduate who holds them. Where there is a repletion, the party can demand no more by virtue of his degrees. In England, where benefices are not appropriated to degrees, repletion, ſtrictly ſpeaking, has no place.

REPLEVIN, in law, a remedy granted on a diſtreſs, by which the firſt poſſeſſor has his goods reſtored to him again, on his giving ſecurity to the ſheriff that he will purſue his action againſt the party diſtraining, and return the goods or cattle, if the taking them ſhall be adjudged lawful.

REPLEVISH, in law, ſignifies to admit one to mainprize upon ſurety.

REPLEVY, in law, is a tenant's bringing a writ of replevin, or replegiari facias, where his goods are taken by diſtreſs for rent; which muſt be done within five days after the diſtreſs, otherwiſe at the five days end, they are to be appraiſed and ſold. 2 W. and M. c. 5.

This word is alſo uſed for bailing a perſon, as in the caſe of a homine replegiando.

REPLICATION, in logic, the aſſuming or uſing the ſame term twice in the ſame propoſition.

REPORT, the relation made upon oath, by officers or perſons appointed to viſit, examine, or eſtimate the ſtate, expences, &c. of any thing.

REPORT, in law, is a public relation of caſes judiciouſly argued, debated, reſolved, or adjudged in any of the king's courts of juſtice, with the cauſes and reaſons of the ſame, as delivered by the judges.

REPOSE, in poetry, &c. the ſame with reſt and pauſe. See REST, &c.

REPOSE, in painting, certain maſſes or large aſſemblages of light and ſhade, which being well conducted, prevent the confuſion of objects and figures, by engageing and fixing the eye ſo as it cannot attend to the other parts of the painting for ſome time; and thus leading it to conſider the ſeveral groups gradually, proceeding, as it were, from ſtage to ſtage.

REPOSITORY, a ſtore-houſe, or place in which things are laid up, and preſerved.

REPRESENTATION, in the drama, the exhibition of a theatrical piece, together with the ſcenes, machines, &c.

REPRESENTATIVE, one who perſonates or ſupplies the place of another, and is inveſted with his right and authority.

REPRIEVE, or REPRIVE, in law, is ſuſpending or deferring the execution of the law upon a priſoner for a certain time; or a warrant from the king for deferring the execution of a perſon condemned.

REPRISALS, a right which princes claim of taking from their enemies any thing equivalent to what they unjuſtly detain from them.

REPRIZE, or REPRISE, at ſea, is a merchant-ſhip which, after its being taken by a corſair, privateer, or other enemy, is retaken by the oppoſite party.

If a veſſel, thus retaken, has been twenty-four hours in poſſeſſion of the enemy, ſhe is deemed a legal prize; but if it be retaken within that time, ſhe is to be reſtored to the proprietor, with every thing therein, upon his allowing one third to the veſſel who made the reprize. Alſo, if the reprize has been abandoned by the enemy, either in a tempeſt, or from any other cauſe, before ſhe has been taken into any port, ſhe is to be reſtored to the proprietor.

REPRIZES, in law, are deductions or payments annually made out of a manor or lands; as rent-charges, penſions, annuities, &c.

REPROBATION, in theology, a decree by which God is ſuppoſed either from all eternity, or from the creation of the world, to conſign over to eternal miſery the greateſt part of mankind, and to ſave none of the human race except thoſe whom he made the heirs of glory by election.

Caſuiſts diſtinguiſh two kinds of reprobation, poſitive and negative. Poſitive reprobation, is that by which God is ſuppoſed to create men with a poſitive and abſolute reſolution to damn them eternally: and negative reprobation, is that whereby God, though he creates all men with a ſincere deſire to ſave them, and furniſhes them with all the neceſſary means of ſalvation, ſo that all may be ſaved that will; yet ſees there are ſeveral who will not do it, with the aids he ſhall afford them, and ſees, at the ſame time, they would do it with certain other aids, which he ſees, but will not give them.

RE-

REPRODUCTION, the act whereby a thing is produced anew, or grows a second time.

REPTILES, in natural history, a kind of animals denominated from their creeping or advancing on the belly. Or reptiles are a genus of animals and insects, which, instead of feet, rest on one part of the body, while they advance forward with the rest.

Such are earthworms, snakes, caterpillars, &c. Indeed, most of the class of reptiles have feet; only those very small, and the legs remarkably short in proportion to the bulk of the body.

Naturalists observe a world of artful contrivance for the motion of reptiles. Thus, particularly in the earthworm, Dr. Willis tells us, the whole body is only a chain of annular muscles; or, as Mr. Derham says, it is only one continued spiral muscle, the orbicular fibres whereof being contracted, render each ring narrower and longer than before; by which means it is enabled, like the worm of an augre, to bore its passage into the earth. Its reptile motion might also be explained by a wire wound on a cylinder, which when slipped off, and one end extended and held fast, will bring the other near to it. So the earth-worm having shot out or extended his body (which is with a wreathing) it takes hold by these small feet it hath, and so contracts the hinder part of its body. Dr. Tyson adds, that when the fore-part of the body is stretched out, and applied to a plane at a distance, the hind part relaxing and shortening is easily drawn towards it as a center.

Its feet are disposed in a quadruple row the whole length of the worm, with which, as with so many hooks, it fastens down sometimes this and sometimes that part of the body to the plane, and at the same time stretches out or drags after it another.

The creeping of serpents is effected after a somewhat different manner; there being a difference in their structure, in that these last have a compages of bones articulated together.

The body here is not drawn together, but as it were complicated; part of it being applied on the rough ground and the rest ejaculated and shot from it, which, being set on the ground in its turn, brings the other after it. The spine of the back variously wreathed has the same effect in leaping, as the joints in the feet of other animals; they make their leaps by means of muscles, and extend the plicæ or folds.

REPTILE is also used, by some botanical writers, to signify plants which creep upon the earth, unless sustained by some other plant, prop, &c. as cucumbers, melons, the vine, &c.

REPUBLIC, *Respublica*, commonwealth, a popular state or government; or a nation where the people have the government in their own hands.

REPUBLIC *of Letters*, a phrase used collectively of the whole body of the people of study and learning.

REPUDIATION, *Repudium*, in the civil law, the act of divorcing. See DIVORCE.

REPULSION, *Repulsio*, in physics, that property in bodies, whereby, if they are placed just beyond the sphere of each other's attraction of cohesion, they mutually fly from each other.

REQUIEM, in the Romish church, a mass sung for the rest of the soul of a person deceased.

RESCEIT, *Receptio*, in law, an admission or receiving of a third person to plead his right in a cause formerly commenced between the other two.

RESCISSION, *Rescissio*, in the civil law, an action intended for the annulling, or setting aside, any contract, deed, &c.

RESCRIPT, *Rescriptum*, an answe delivered by an emperor, or a pope, when consulted by particular persons, on some difficult question, or point of law; to serve as a decision thereof.

RESEARCH, a scrutiny, or diligent enquiry into any thing.

RESEARCH, in music, is a kind of prelude or voluntary played on the organ, &c. wherein the performer seems to search or look out for the strains and touches of harmony, which he is to use in the regular piece to be played afterwards.

RESEARCHING, in sculpture, the repairing of a cast figure, &c. with proper tools; or the finishing it with art and exactness, so as the minutest parts may be well defined.

RESERVATION, in law, an action or clause whereby something is reserved, or secured to one's self.

Mental RESERVATION, a proposition, which strictly taken, and according to the natural import of the terms, is false; but, if qualified by something concealed in the mind, becomes true.

RESERVE, in law, the same with reservation. See the article RESERVATION.

Body of RESERVE, or *Corps de* RESERVE, in military affairs, the third or last line of an army, drawn up for battle; so called, because they are reserved to sustain the rest, as occasion requires; and not to engage, but in case of necessity.

RESERVOIR, a place where water is collected and reserved, in order to be conveyed to distant places through pipes, or supply a fountain, or jet d'eau.

RESET, in law, the receiving or harbouring an outlawed person.

RESIDENCE, in the canon and common law, the abode of a person, or incumbent, upon his benefice; and his assiduity in attending on the same.

RESIDENT, a public minister, who manages the affairs of a kingdom or state, at a foreign court.

RESIDENTIARY, *Residentiarius*, a canon installed into the privileges and profits of residence.

RESIDUAL FIGURE, in geometry, the figure remaining, after subtracting a lesser from a greater.

RESIDUAL ROOT, in algebra, a root composed of two parts or members, connected together by the sign —.

Thus $x-y$ is a residual root, so called, because its value is no more than the difference between its parts x and y.

RESIDUE, *Residuum*, the remainder or balance of an account, debt, or obligation.

RESIGNATION, in the canon law, the surrendering a benefice into the hands of the collator, or bishop.

RESIGNEE, in law, the person to whom a thing is resigned.

RESIN, in natural history, a viscid juice oozing either spontaneously, or by incision, from several trees, as the pine, fir, &c.

For the difference between resins and gums, see the article GUM.

Natural resins are either solid or fluid. Of the solid resins, some are used more frequently in medicine, as storax, benzoine, mastich, olibanum, elemi, lac, dragon's-blood, and camphor; and others more rarely, as anime, copal, caranna, tachamahaca, laudanum, sandarach, &c. See STORAX, BENZOINE, &c.

The liquid resins, used in medicine, are less numerous, viz. balsam of Gilead, of Peru, of Tolu, of capivi, turpentine, liquid amber, and liquid storax. See the articles BALSAM, TURPENTINE, &c. &c.

RESISTENCE, or RESISTING *Force*, in philosophy, any power which acts opposite to another, so as to destroy or diminish its effect.

There are various kinds of resistence, arising from the various natures and properties of the resisting bodies, and governed by various laws, as the resistence of solids, the resistence of fluids, resistence of the air, &c.

Theory of the RESISTENCE *of the Fibres of solid Bodies.*— To conceive the idea of this resistence, or renitency, of the parts, suppose a cylindrical body suspended vertically by one end. — Here, all its parts, being heavy, draw downwards, and tend to separate the two contiguous planes, where the body is the weakest: but all the planes resist this separation by the force wherewith they cohere, or are bound together: here, then, are two opposite powers; viz. the weight of the cylinder which tends to break it, and the force of cohesion of the parts which resists the fracture.

If the base of the cylinder be increased, without increasing its length; it is evident the resistence will be increased in the same ratio as the strength of the base: but the weight also increases in the same ratio; whence it is evident that all cylinders of the same matter and length, whatever

whatever their baſes be, have an equal reſiſtence, when vertically ſuſpended.

If the length of the cylinder be increaſed without increaſing the baſe, its weight is increaſed without increaſing its reſiſtence; conſequently the lengthening it weakens it. To find the greateſt length a cylinder of any matter may have without breaking, there needs nothing but to take any cylinder of the ſame matter, and faſten it to the greateſt weight it will ſuſtain before it breaks; and then ſee how much it muſt be lengthened by the addition of its weight, till it equals its former weight with the addition of a foreign weight. By this means Galileo found a copper-wire, and of conſequence any other cylinder of copper, might be extended to 4801 braccio's, or fathoms of ſix feet each.

If one end of the cylinder were fixed horizontally into a wall, and the reſt ſuſpended thence, its weight, and reſiſtence, would then act in a different manner; and, if it broke by the action of its weight, the rupture would be at the end fixed into the wall. A circle or plane contiguous to the wall, and parallel to the baſe, and conſequently vertical, would be detached from the contiguous circle within the plane of the wall, and would deſcend. All the motion is performed on the loweſt extremity of the diameter, which remains immoveable, while the upper extremity deſcribes a quadrant of a circle, and till the circle which before was vertical becomes horizontal; i. e. till the cylinder be entirely broken.

In this fracture of the cylinder it is viſible two forces have acted, and the one has overcome the other: the weight of the cylinder, which aroſe from its whole maſs, has overcome the reſiſtence which aroſe from the largeneſs of the baſe; and as the centers of gravity are points wherein all the forces ariſing from the weights of the ſeveral parts of the ſame bodies are conceived to be united, one may conceive the weight of the whole cylinder applied in the center of gravity of its maſs; i. e. in a point in the middle of its axis; and the reſiſtence of the cylinder applied in the center of gravity of its baſe; i. e. in the center of the baſe: it being the baſe which reſiſts the fracture.

Hence it follows, that the force wherewith a cylinder or any other ſolid body having one end thereof fixed horizontally into a wall, and the reſt ſuſpended thence, endeavours to break off at the wall, will be as the whole weight of the body drawn into the diſtance of its center of gravity from the wall directly, and the ſtrength of the baſe of the ſolid next the wall inverſely.

When the cylinder breaks by its own weight, all the motion is on an immoveable extremity of a diameter of the baſe.—This extremity, therefore, is the fixed point of a lever, whoſe two arms are the radius of the baſe, and half the axis: and, of conſequence, the two oppoſite forces do not only act of themſelves, and by their abſolute force, but alſo by the relative force they derive from their diſtance with regard to the fixed point of the lever.

Hence it evidently follows, that a cylinder, e. gr. of copper, which, vertically ſuſpended, will not break by its own weight, if leſs than 480 fathom long, will break with a leſs length in a horizontal ſituation; in regard the length in this latter caſe contributes two ways to the fracture; both as it makes it of ſuch a weight, and as it is an arm of a lever to which the weight is applied.—Hence, alſo, the ſmaller the baſe is, the leſs length or weight will ſuffice to break it; both becauſe the reſiſtence is really leſs, and becauſe it acts by a leſs arm of a lever.

If two cylinders of the ſame matter, having their baſes and lengths in the ſame proportion, be ſuſpended horizontally; it is evident that the greater has more weight than the leſſer, both on account of its length, and of its baſe. But it has leſs reſiſtence on account of its length, conſidered as a longer arm of a lever, and has only more reſiſtence on account of its baſe.—Therefore it exceeds the leſſer in its bulk and weight, more than in reſiſtence; and conſequently muſt break more eaſily.

Hence we ſee why, upon making models and machines in ſmall, people are apt to be miſtaken as to the reſiſtence and ſtrength of certain horizontal pieces, when they come to execute their deſigns in large; by obſerving the ſame proportion as in the ſmall.—Galileo's doctrine of reſiſtence therefore is no idle ſpeculation, but becomes applicable in architecture and other arts.

The weight required to break a body placed horizontally being always leſs than that required to break it in a vertical ſituation; and this weight being to be greater or leſs according to the ratio of the two arms of the lever; the whole theory is always reducible to this, viz. to find what part of the abſolute weight the relative weight is to be, ſuppoſing the figure of the body known, which indeed is neceſſary, becauſe it is the figure that determines the two centers of gravity, or the two arms of the lever.—For if the body, e. g. were a cone, its center of gravity would not be in the middle of its axis, as in the cylinder; and if it were a ſemiparabolical ſolid, neither its center of gravity would be in the middle of its length or axis, nor the center of gravity of its baſe in the middle of the axis of its baſe. But ſtill, whereſoever theſe centers fall in the ſeveral figures, it is theſe that regulate the two arms of the lever.

It may be obſerved here, that if the baſe, whereby the body is faſtened into the wall, be not circular, but, e. g. parabolical, and the vertex of the parabola a-top, the motion of the fracture will not be on an immoveable point, but on a whole immoveable line, which may be called the axis of equilibrium; and it is with regard to this, that the diſtance of the centers of gravity are to be determined.

Now, a body, horizontally ſuſpended, being ſuppoſed ſuch, as that the ſmalleſt addition of weight would break it; there is an equilibrium between its poſitive and relative weight; and, of conſequence, their two oppoſite powers are to each other reciprocally as the arms of the lever to which they are applied. On the other hand, the reſiſtence of a body is always equal to the greateſt weight which it will ſuſtain in a vertical ſituation without breaking, i. e. is equal to its abſolute weight. Therefore, ſubſtituting the abſolute weight for the reſiſtence, it appears that the abſolute weight of a body, ſuſpended horizontally, is to its relative weight, as the diſtance of its center of gravity of its baſe from the ſame axis.

The diſcovery of this important truth, at leaſt of an equivalent hereto, and to which this is reducible, we owe to Galileo. From this fundamental proportion are eaſily deduced ſeveral conſequences. As for inſtance, that if the diſtance of the center of gravity of the baſe from the axis of equilibrium, be half the diſtance of the center of gravity of the body; the relative weight will only be half the abſolute weight; and, that a cylinder of copper horizontally ſuſpended, whoſe length is double the diameter, will break, provided it weigh half what a cylinder of the ſame baſe, 4801 fathoms long, weighs. On this ſyſtem of reſiſtence of Galileo, M. Mariotte made a very ſubtle remark, which gave birth to a new ſyſtem. Galileo ſuppoſes that, where the body breaks, all the fibres break at once; ſo that the body always reſiſts with its whole abſolute force; i. e. with the whole force all its fibres have, in the place where it is broke. But, M. Mariotte finding that all bodies, even glaſs itſelf, bend before they break, ſhews that fibres are to be conſidered as ſo many little bent ſprings, which never exert their own force till ſtretched to a certain point, and never break till entirely unbent. Hence thoſe neareſt the axis of equilibrium, which is an immoveable line, are ſtretched leſs than thoſe farther off, and of conſequence employ a leſs part of their force.

This conſideration only takes place in the horizontal ſituation of the body: in the vertical, the fibres of the baſe all break at once; ſo that the abſolute weight of the body muſt exceed the united reſiſtence of all its fibres: a greater weight is therefore required here, than in the horizontal ſituation; i. e. a greater weight is required to overcome their united reſiſtence, than to overcome their ſeveral reſiſtences one after another. The difference between the two ſituations ariſes hence, that in the horizontal there is an immoveable point or line, a center of motion which is not in the vertical.

M. Varignon has improved on the ſyſtem of M. Mariotte, and ſhewn that to Galileo's ſyſtem it adds the conſideration of the center of percuſſion. The compa-

ſion of the centers of gravity with the centers of percuſſion afford a fine view, and ſet the whole doctrine in the moſt agreeable light.

In each ſyſtem, the baſe whereby the body breaks, moves on the axis of equilibrium, which is an immoveable line in the ſame baſe; but, in the ſecond, the fibres of this baſe are continually ſtretching more and more, and that in the ſame ratio, as they recede farther and farther from the axis of equilibrium, and, of conſequence, are ſtill exerting a greater and greater part of their whole force.

Theſe unequal extenſions, like all other forces, muſt have ſome common center where they all meet, and with regard to which they make efforts on each ſide: and as they are preciſely in the ſame proportion as the velocities which the ſeveral points of a rod moved circularly would have to one another; the center of extenſion of the baſe, whereby the body breaks, or tends to break, muſt be the ſame with its center of percuſſion. Galileo's hypotheſis, where fibres ſtretch equally, and break all at once, correſponds to the caſe of a rod moving parallel to itſelf; where the center of extenſion or percuſſion does not appear, as being confounded with the center of gravity.

The baſe of fraction being a ſurface whoſe particular nature determines its center of percuſſion, it is neceſſary to be firſt known to find on what point of the vertical axis of that baſe it is placed, and how far it is from the axis of equilibrium—Indeed, we know in the general, that it always acts with ſo much more advantage as it is farther from it, in regard it acts by a longer arm of a lever; and of conſequence it is the unequal reſiſtence of the fibres in M. Mariotte's hypotheſis, which produces the center of percuſſion; but this unequal reſiſtence is greater or leſs according as the center of percuſſion is placed more or leſs high on the vertical axis of the baſe, in the different ſurfaces of the baſe of the fracture.

To expreſs this unequal reſiſtence, accompanied with all the variations it is capable of, regard muſt be had to the ratio between the diſtance of the center of percuſſion from the axis of equilibrium, and the length of the vertical axis of the baſe—In which ratio, the firſt term, or the numerator, is always leſs than the ſecond or the denominator: ſo that the ratio is always a fraction leſs than unity; and the unequal reſiſtence of the fibres in M. Mariotte's hypotheſis is ſo much the greater, or which amounts to the ſame, approaches ſo much nearer to the equal reſiſtence in Galileo's hypotheſis, as the two terms of the ratio are nearer to an equality.

Hence it follows, that the reſiſtence of bodies, in M. Mariotte's ſyſtem, is to that in Galileo's, as the leaſt of the terms in the ratio is to the greateſt—Hence, alſo, the reſiſtence being leſs than what Galileo imagined, the relative weight muſt alſo be leſs; ſo that the proportion already mentioned between the abſolute and relative weight cannot ſubſiſt in the new ſyſtem, without an augmentation of the relative weight, or a diminution of the abſolute weight: which diminution is had by multiplying the weight by the ratio, which is always leſs than unity. This done, we find that the abſolute weight, multiplied by the ratio, is to the relative weight, as the diſtance of the center of gravity of the body from the axis of equilibrium is to the diſtance of the center of gravity of the baſe of fracture from the ſame axis. Which is preciſely the ſame thing with the general formula given by M. Varignon, for the ſyſtem of M. Mariotte. In effect, after conceiving the relative weight of a body, and its reſiſtence equal to its abſolute weight, as two contrary powers applied to the two arms of a lever, in the hypotheſis of Galileo; there needs nothing to convert it into that of M. Mariotte, but to imagine that the reſiſtence, or the abſolute weight, is become leſs, every thing elſe remaining the ſame.

We have here only conſidered bodies as to be broke by their own weight—It will amount to the ſame, if we ſuppoſe them void of weight themſelves, and to be broken by a weight applied to their extremities: only it is to be obſerved, that a foreign weight acts by an arm of a lever equal to the whole length of a body; whereas their own weight, being all united in the center of gravity, is only the diſtance of that center from the axis of equilibrium.

One of the moſt curious, and perhaps the moſt uſeful queſtions in this reſearch, is to find what figure a body muſt have, that its reſiſtence may be equal in all its parts; whether it be conceived as loaden with a foreign weight, or as only ſuſtaining its own weight—We ſhall, here, only conſider the latter caſe, from which the former will be eaſily determined. For a body, then, ſuſpended horizontally, to reſiſt equally in all its parts; it is neceſſary, ſome part of it being conceived as cut off in a plane parallel to the baſe of fracture of the body, the weight of the part retrenched be to its reſiſtence, in the ſame ratio, as the weight of the whole to its reſiſtence; theſe four powers acting by arms of levers peculiar to themſelves—Now the weight of any body, thus conceived, is its whole weight multiplied by the diſtance of the center of gravity of the body from the axis of equilibrium; and the reſiſtence is the plane of the baſe of fracture multiplied by the diſtance of the center of gravity of the baſe from the ſame axis: conſequently theſe four quantities are to be proportional in the whole, and in each part of a ſolid of equal reſiſtence.

From this proportion M. Varignon eaſily deduces two ſolids, which ſhall reſiſt equally in all their parts. Galileo had found one before: that diſcovered by M. Varignon is in form of a trumpet, and is to be fixed into the wall at its greater end; ſo that its bigneſs and weight is always diminiſhed in proportion as its length, or the arm of the lever whereby its weight act increaſes. It is added (which ſeems very remarkable) that, howſoever different the two ſyſtems may be, the ſolids of equal reſiſtence are the ſame in both.

RESISTENCE *of fluids*, in hydroſtatics, is the force wherewith bodies, moving in fluid mediums, are impeded and retarded in their motion.

Laws of the RESISTENCE *of fluid Mediums.*—The reſiſtence a body meets with in moving through a fluid, is of three kinds; the firſt ariſes from the friction of the body againſt the particles of the fluid; the ſecond from their coheſion or tenacity among themſelves; the third, from their inactivity, or the tendency they have, in common with other bodies, to keep the places they poſſeſs.

The firſt, viz. that which ariſes from the friction of the body againſt the particles of the fluid, is very inconſiderable; for whatever the weight is, which preſſes the particles of a fluid together, the freedom, with which a body moves through it, is not ſenſibly diminiſhed thereby.

The ſecond, or that which ariſes from the tenacity of the particles of the fluid, is as the time the body continues paſſing in it: thus, ſuppoſe a body continues to move within a fluid for the ſpace of one hour; if its motion be very quick during that time, it then moves a great way in that fluid, and conſequently meets with a great deal of the fluid to reſiſt it; but is reſiſted the leſs in each part thereof, in proportion to the ſtay it makes there: whereas, if its motion be ſlow, it then moves but a little way in that time, but is reſiſted ſo much the longer in each part thereof. So that, whether the body moves faſt or ſlow, the reſiſtence it ſuffers is the ſame; and depends, therefore, on nothing but the time we ſuppoſe it to continue moving within the fluid. This ſpecies of reſiſtence is alſo very ſmall, except in glutinous and viſcid fluids, whoſe parts are not eaſily ſeparated.

The third ſpecies is the principal reſiſtence that fluids give to bodies, and ariſes from their inactivity, or the tendency the particles, of which they conſiſt, have to continue at reſt. The quantity of this reſiſtence depends on the velocity the body moves with, on a double account: for, in the firſt place, the number of particles put into motion by the moving body in any determinate ſpace of time, is proportionable to the velocity wherewith the body moves; and, in the next place, the velocity with which each of them is moved, is alſo proportionable to the velocity of the body; this ſpecies, therefore, of reſiſtence, is in a duplicate proportion, or as the ſquare of the velocity, with which the body moves thro' the fluid.

2. Farther, the reſiſtence a body moving in a fluid meets with from thence, may be conſidered with regard to the fluid; and then it will be found to be more or leſs, according to the denſity of the fluid. For by how much denſer the fluid is, ſo much the greater number of particles are to be put into motion by the body, in order to make its way through it.

3. The next thing to be conſidered is, the effects of the reſiſtence of fluids upon bodies moving in them; that is, the retardation, which they cauſe in the motion of a body by their reſiſtence, or the quantity of motion they deſtroy.

And this, in ſimilar bodies of equal magnitudes, is inverſely as their denſities, or the quantity of matter they contain; for by how much the greater the quantity of matter in any body is, ſo much the more eaſily does it overcome the reſiſtence it meets with from the fluid. Thus, we ſee the reſiſtence of the air has a much leſs effect in deſtroying the motion of an heavy body, than of a light one which has the ſame dimenſions.

4. In ſimilar bodies of equal denſities, but different magnitudes, the ratardation is inverſely as their homologous ſides. For the reſiſtence bodies meet with in a fluid, is inverſely as the quantities of matter they contain (by the laſt) that is, inverſely as the cubes of their homologous ſides; and it is alſo directly as their ſurfaces, becauſe it is by them that they move the fluid out of its place; that is, directly as the ſquares of their homologous ſides; conſequently, the retardation is inverſely as their homologous ſides.

RESISTENCE *of the Air to the motion of projectiles.*—In Phil. Tranſ. N°. 186. there is the meaſure of this given very largely and accurately by Dr. Wallis: He lays down at firſt this lemma, that the reſiſtence of bodies is proportional to their celerity; and then branches it out into all the particular varieties that can well be imagined, and at laſt, comparing different mediums one with another, he concludes their different reſiſtences to be as their ſpecific gravities, obſtructed from the viſcidity of the particles of ſome fluids: and alſo that the ſpecifically heavier project once in motion (being equally ſwift with another that is lighter, &c.) will move through the ſame medium more ſtrongly in proportion to its greater intenſive or ſpecific gravity.

In the Acta Eruditorum Lipſiæ for July 1684, Mr. G. G. Leibnitz propoſes ſome new demonſtrations about the reſiſtences of ſolid bodies, which are very geometrical and curious.

And in the Leipſic Acts for January 1689, he reduces his thoughts on this ſubject into a diſſertation, intitled, A diſcourſe concerning the reſiſtence of mediums, and the motion of projects in reſiſting mediums.

As to the geometrical conſiderations of the reſiſtence of bodies of different figures in one and the ſame medium, Mr. James Bernoulli, in the Acta Lipſiæ for May 1693, gives theſe rules:

1. If an iſoſceles triangle be moved in the fluid according to the direction of a line which is normal to its baſe; firſt with the vertex foremoſt, and then with its baſe; the reſiſtences will be as the legs, and as the ſquare of the baſe, and as the ſum of the legs.

2. The reſiſtence of a ſquare moved according to the direction of its ſide, and of its diagonal, is as the diagonal to the ſide.

3. The reſiſtence of a circular ſegment (leſs than a ſemi-circle) carried in a direction perpendicular to its baſis, when it goes with the baſe foremoſt, and when with its vertex foremoſt (the ſame direction and celerity continuing, which is all along ſuppoſed) is as the ſquare of the diameter to the ſame leſs one-third of the ſquare of the baſe of the ſegment.

Cor. Hence the reſiſtences of a ſemi-circle when its baſe, and when its vertex goes foremoſt, are to one another in a ſeſquialteral ratio.

4. A parabola moving in the direction of its axis, with its baſis, and then its vertex foremoſt, has its reſiſtences, as the tangent to an arch of a circle, whoſe diameter is equal to the parameter, and the tangent equal to half the baſis of the parabola.

5. The reſiſtences of an hyperbola, or the ſemi-ellipſis, when the baſe and when the vertex goes foremoſt, may be thus computed: let it be, as the ſum, or difference, of the tranverſe axis, and latus rectum, is to the tranverſe axis: : ſo is the ſquare of the latus rectum to the ſquare of the diameter of a certain circle; in which circle apply a tangent equal to half the baſis of the hyperbola or ellipſis. Then ſay again, as the ſum, or difference, of the axis and parameter is to the parameter; ſo is the aforeſaid tangent to another right line. And further, as the ſum, or difference, of the axis and parameter is to the axis: : ſo is the circular arch, correſponding to the aforeſaid tangent, to another arch. This done, the reſiſtences will be as the tangent to the ſum, or difference, of the right line thus found, and that arch laſt mentioned.

6. In general, the reſiſtences of any figure whatſoever going now with its baſe foremoſt, and then with its vertex, are as the figures of the baſis to the ſum of all the cubes of the elementa of the baſis divided by the ſquares of the elementa of the curve line.

All which rules, he thinks, may be of uſe in the fabric or conſtruction of ſhips, and in perfecting the art of navigation univerſally. As alſo for determining the figures of the bobs of pendulums for clocks.

Solid of leaſt RESISTENCE, a ſolid that, in paſſing thro' a reſiſting medium, has the leaſt reſiſtence of any, containing the ſame quantity of matter and ſurface. See SOLID *of leaſt Reſiſtence.*

RESOLUTION, in chemiſtry, &c. the reduction of a mixed body into its component parts, or firſt principles, by a proper analyſis.

RESOLUTION, in medicine, that coction or alteration of the crude peccant matter of any diſeaſe, either by the natural ſtrength of the patient, or of its own accord, or by the application of remedies, whereby its bulk, figure, coheſion, &c. are ſo far changed, as that it ceaſes to be morbid, and becomes laudable. This Boerhaave obſerves, is of all others the moſt perfect cure, where it is effected without any evacuation, as ſuppoſing the matter favourable, the conſtitution excellent, and the medicines good.

RESOLUTION, in muſic, is when a canon or perpetual figure is not wrote on a line, or in one part; but all the voices that are to follow the guide or firſt voice, are wrote ſeparately either in ſcore, that is in ſeparate lines, or in ſeparate parts, with the pauſes each is to obſerve, and in the proper tone to each.

RESOLVENTS, *Reſolventia*, in medicine, remedies proper to reſolve and diſſipate tumours and gatherings; to ſoften indurations, and, by their tenuity and warmth, evacuate redundant or peccant humours through the pores. Under this claſs come various unguents, emplaſters, &c.

RESONANCE, RESOUNDING, in muſic, &c. a ſound returned by the air, incloſed in the bodies of ſtringed muſical inſtruments, as lutes, &c. or even in the bodies of wind inſtruments, as flutes, &c. See SOUND and MUSIC.

Elliptic and parabolic vaults reſound ſtrongly, that is, they will reflect or return a ſound. The mouth, and the parts thereof, as the palate, tongue, teeth, noſe, and lips, M. Dodart obſerves, contribute nothing to the tone of the voice, but their effect is very great as to the reſonance: of this we have a very ſenſible inſtance in that vulgar inſtrument called a Jews-harp, or trompe de Bearn; for if you hold it in your hand, and ſtrike the tongue or ſpring thereof, which is the method practiſed to ſound this inſtrument, it yields ſcarce any noiſe; but holding the body of it between the teeth, and ſtriking it as before, it makes a muſical buzz, which is heard at a good diſtance, and eſpecially the lower notes.

RESPIRATION, *reſpiratio*, the act of reſpiring, or breathing the air. What reſpiration is, and why it is uninterruptedly carried on without the concurrence of the mind, will appear from the following conſiderations of Boerhaave.

The lungs ſuſpended in the air, which every where acts upon them, and equally preſſes them always, collapſe, contract themſelves into a ſmaller ſpace, and become much leſs than when they remain in the intire thorax. This is principally performed by the contractile force of the muſcular fibres, which connect the ſquamous ſegments of the bronchia. If the lungs thus contracted,

tracted, are filled with air, forcibly blown through the glottis, they are so distended as, in bulk, not only to equal that which they had in the intire thorax, but even to exceed it; all which is sufficiently certain from experiments. The same thing happens if, when an access for the air through the glottis is left to the lungs, the air externally acting on the lungs, is either removed, or its pressure diminished. Hence it is obvious, that the lungs, by their proper force, have always a tendency to become less in all their parts than they are when placed in the entire thorax. For this reason, it is certain that they are in a continual state of distraction so long as a person is alive, so that they must collapse, and be diminished, whilst the whole of the animal remains in a vacuum, obtained by an exhaustion of the air in an air-pump. For there is nothing similar to a circumambient air between the external membrane of the lungs, and all the internal surface of the pleura in a sound person; nothing therefore externally compresses the lungs, except the diaphragm. There is, however, always an internal air contained in them, and freely conveyed to them through the glottis. Hence the lungs are always somewhat more distended by the internal, than they are compressed by the external air, the access of which is hindered by the diaphragm, which is so connected with the ribs and vertebræ, that the air cannot enter the thorax in such a manner as would be requisite for an equilibrium.

Since, therefore, in inspiration, a greater quantity of air enters the lungs through the glottis, it will extend the lungs more, and overcome their natural force, so that in this action the lungs are passive; but how far they are active is only to be discovered from certain phænomena. In vital inspiration, then, especially considered in a sleeping person, first the ribs, particularly the nine superior ones, articulated at the vertebræ, and by cartilages joined to the sternum, with their arched part, rise to the clavicles, so that this motion is principally observed in the middle of the arch, whilst three, or perhaps four, inferior ribs are turned downwards, backwards, and obliquely outwards, but in such a manner that the seventh, eighth, ninth, and tenth ribs are by their cartilaginous segments, as it were, drawn inwards. Secondly, the whole abdomen, to the very end of inspiration, is gradually rendered more tumid and pressed downwards. Thirdly, at the same time the cavity of the thorax is enlarged, as is obvious from repeated experiments.

Whilst the parts remain in this situation, the air acts upon the lungs with a force equal to that with which the thorax resists, so that the lungs will remain in a state of rest. Hence less blood will pass through them, and a smaller quantity of it will be forced into the left ventricle of the heart, and consequently less blood will be conveyed to the cerebellum and its nerves. The arterial blood will also act less upon the intercostal muscles and diaphragm, so that the causes dilating the thorax are weakened. Hence the elasticity of the cartilaginous segments again depresses the ribs, in which work they are also assisted by the muscular fibres arising from the side of the sternum within the thorax, and inserted into the bony extremities, and cartilages of the true ribs. At the same time the distracted fibres of the peritonæum and abdominal muscles restore themselves. Hence the compressed viscera thrust the relaxed diaphragm upwards into the thorax, which is by this means contracted, and the air expelled from the lungs. By this means, expiration and the action already mentioned, are performed. But in a particular manner by these two actions the blood is not only carried through the lungs, but its motion accelerated. See CIRCULATION, &c.

Physicians are not agreed about the use and effects of respiration; some think that the air is insinuated into the vessels of the lungs, to give a greater fluidity and motion to the blood; others, that it conveys very subtile nitrous corpuscles thereunto, which gives it the red colour; others again, believe the air serves to condense the blood, which has been heated by circulation. This is certain, that the air entering into the lungs, and all the small ramifications which surround its vesicles, is broke, comminuted, and rendered more fluid, and that it is deprived of a serosity, which proceeds from the lungs by perspiration, in the form of a vapour that is visible in cold weather. It may be added, that the voice, laughter, coughing, sneezing, yawning, and sucking, depend upon respiration. Boerhaave takes the principal uses of respiration to be the further preparation of the chyle, its more accurate mixture with the blood, and its conversion into a nutritious juice, proper to repair the decays of the body. Other authors take a great use of respiration to be, by the neighbourhood of the cold nitrous air, to cool the blood coming reeking hot out of the right ventricle of the heart through the lungs, and to act as a refrigeratory; others assert one grand use of respiration to be the throwing off the fuliginous vapours of the blood, along with the expelled air; and for inspiration they assert, that it conveys a nitro-aerial ferment to the blood, to which the animal spirits, and all muscular motion, are owing. But Dr. Thurston rejects all these, as being the principal uses of respiration, and from the experiments of Dr. Croon, Dr. Hook, and others, made before the Royal Society, he shews the principal use of respiration to be that of moving, or passing the blood from the right to the left ventricle of the heart, and so to effect circulation; whence it is, that persons hanged, drowned, or strangled, so suddenly die, viz. because the circulation of the blood is stopped, and for the same reason it is, that animals die so speedily in the air-pump. This use of respiration Dr. Drake not only confirms, but carries farther, making it the true cause of the diastole of the heart, which neither Borelli, Dr. Lower, nor Mr. Cowper, had well accounted for. See DIASTOLE and SYSTOLE.

From experiments made upon dogs, and other animals, Dr. Hales shews, that without respiration, the blood would soon turn putrid and pestilential; and indeed the only animal exempted from the necessity of respiration is a foetus. See FOETUS.

With regard to the force of respiration, the last mentioned author observes, that though a man by a peculiar action of his mouth and tongue, may suck mercury twenty-two inches, and some men twenty-seven or twenty-eight, high, yet he found from experience, that by the bare inspiring action of the diaphragm and dilating thorax, he himself could scarcely raise the mercury two inches, at which time the diaphragm must act with a force equal to the weight of a cylinder of mercury, whose base is commensurate to the area of the diaphragm, and its height two inches, whereby the diaphragm must at the same time sustain a weight equal to many pounds; neither are its counteracting muscles, those of the abdomen, able to exert a greater force.

With regard to the quantity of moisture carried off by respiration, the doctor, from an experiment on wood-ashes, estimates that quantity to be equal to seventeen grains in fifty expirations, whence there will proportionably be four hundred and eight grains evaporated, or breathed off, in twelve hundred expirations, being the number in an hour, and thence in twenty-four hours 9792 grains, or 1.39 pounds, which supposing the surface of the lungs to be 41635 square inches, then the quantity evaporated from that inward surface will be $\frac{1}{10\frac{1}{4}}$th part of an inch depth.

From the violent and fatal effects of noxious vapours on the respiration and life of animals, the doctor shews how the respiration is proportionably incommoded when the air is loaded with lesser degrees of vapours, which vapours do in some measure clog and lower the air's elasticity, which it best regains by having these vapours dispelled by the ventilating motion of the free open air, that is best rendered wholesome by the agitation of winds; thus what we call a close warm air, such as has been long confined in a room, without having the vapours in it carried off by communicating with the open air, is apt to give us more or less uneasiness in proportion to the quantity of vapours which are floating in it. And thus, many of those who have weak lungs, but can breathe very well in the fresh country air, are greatly incommoded in their breathing, when they come into large cities, where the air is full of fuliginous vapours; and even the most robust and healthy, in changing from a city to a country air, find an exhilarating pleasure, arising from a more free and kindly inspiration, whereby the lungs being less

loaded with condenſing air and vapours, and thereby the veſicles more dilated with a clearer and more elaſtic air, a freer courſe is thereby given to the blood, and probably, a purer air mixed with it. See the article AIR.

RESPITE, in law, &c. ſignifies a delay, forbearance, or prolongation, of time, granted any one, for the payment of a debt, or the like.

RESPONDENT SUPERIOR, in law, is a ſuperior's anſwering for the inſufficiency of an inferior. Thus, if the ſheriffs of London are inſufficient, the lord-mayor and commonalty muſt anſwer for them, as the ſheriffs ſuperior.

RESPONDENT, in the ſchools, one who maintains a theſis, in any art or ſcience; who is thus called, from his being to anſwer all the objections propoſed by the opponent.

RESPONDENT, in law, a perſon who undertakes to anſwer for another; and alſo, one who binds himſelf as a ſecurity for another perſon's good behaviour.

RESPONSALIS, in law, is a perſon who anſwers for another, in court, at a day aſſigned.

RESPONSARY SONG, an anthem, in which the choriſters ſing by turns.

RESSAULT, in architecture, is the effect of a body which either projects or ſinks back; that is, ſtands more out or in, than another, ſo as to be out of the line or level with it.

REST, *Quies*, the continuance of a body in the ſame place, or its continual application or contiguity to the ſame parts of the ambient or contiguous bodies; and, therefore, is oppoſed to motion. See the article MOTION.

Sir Iſaac Newton defines true or abſolute reſt, to be the continuance of a body in the ſame part of abſolute ſpace; and relative reſt to be the continuance of a body in the ſame part of relative ſpace.

It is one of the laws of nature, that matter is indifferent to motion or reſt, as has been ſhewn under the article INERTIA.

REST, conſidered in a phyſical view, is only ſalutary, in ſo far as it is duly proportioned to the exerciſe; for a ſedentary idle life brings on many indiſpoſitions.

REST, in poetry, is a ſhort pauſe of the voice in reading, being the ſame with the cæſura, which, in Alexandrine verſes, falls on the ſixth ſyllable; but in verſes of ten or eleven ſyllables, on the fourth.

REST, in muſic, the ſame with pauſe. See the article PAUSE.

RESTAURATION, in ſculpture, is the repairing a mutilated ſtatue, &c.

Many of the antique ſtatues have undergone a reſtauration; as the Wreſtlers, in the gallery of the great duke of Florence; the Farneſe Hercules; the Faunus in the Villa Borgheſe, at Rome; and the Venus of Arles, in the gallery at Verſailles; but theſe reſtaurations have all been made by the ableſt ſculptors.

RESTINCTION, in chemiſtry, is the quenching a metal or mineral in ſome liquor, in order either to correct or exhale it, by giving it ſome new power or quality.

RESTITUTION, in phyſics, is reſtoring an elaſtic body, forcibly bent, to its natural ſtate. See the article ELASTICITY.

RESTITUTION, in a moral and legal ſenſe, is reſtoring a perſon to his right; or returning ſomething unjuſtly taken or detained from him.

RESTITUTION *of Medals*, or RESTITUTED MEDALS, is a term uſed by antiquaries, for ſuch medals as were ſtruck by the emperors, to retrieve the memory of their predeceſſors.

RESTIVE, or RESTY, in the manege, a ſtubborn, unruly, ill-broken horſe, that ſtops, or runs back, inſtead of advancing forward.

RESTORATIVE, in medicine, a remedy proper for reſtoring and retrieving the ſtrength and vigour both of the body and animal ſpirits.

RESTRICTION, among logicians, is limiting a term, ſo as to make it ſignify leſs than it uſually does.

RESTRINGENT, in medicine, the ſame with aſtringent. See ASTRINGENT.

RESULT, what is gathered from a conference, inquiry, meditation, or the like; or the concluſion and effect thereof.

RESURRECTION, in theology, riſing again from the dead; or a perſon's returning to a ſecond life, with new bodily organs, adapted to the ſtate of its new exiſtence.

One of the greateſt arguments for the truth of Chriſtianity is drawn from the reſurrection of our Saviour; the circumſtances of which are handed down to us in ſo plain and diſtinct a manner, by the Evangeliſts, as make the evidence of this important truth amount to a demonſtration.

Chriſtians generally believe, that at the day of judgment, the very identical body they have now, with the ſame fleſh, blood, and bones, will be raiſed from the dead. But, in oppoſition to this opinion, many texts of ſcripture have been urged, particularly the account given of this important event by St. Paul; beſides ſeveral philoſophical objections.

RESUSCITATION, the ſame with reſurrection and revivification. See REVIVIFICATION.

RETAINER, in law, a ſervant who does not continually dwell in the houſe of his maſter, but only attends upon ſpecial occaſions.

RETAINING FEE, the firſt fee given to a ſerjeant, or counſellor at law, in order to make him ſure, and prevent his pleading on the contrary ſide.

RETALIATION, among civilians, the act of returning like for like. See the article TALIONIS LEX.

RETARDATION, in phyſics, the act of diminiſhing the velocity of a moving body.

If bodies of equal bulk, but of different denſities, be moved through the ſame reſiſting medium, with equal velocity, the medium will act equally on each, ſo that they will have equal reſiſtances, but their motions will be unequally retarded, in proportion to their denſities.

Retarded motion from gravity, is peculiar to bodies projected upwards, and this, in the ſame manner as a falling body is accelerated; only in the latter, the force of gravity acts in the ſame direction with the motion of the body; and in the former in an oppoſite direction.

As it is the ſame force which augments the motion in the falling, and diminiſhes it in the riſing body, a body will riſe till it has loſt all its motion; which it does in the ſame time wherein a body falling would have acquired a velocity equal to that wherewith the body was projected upwards.

RETE MIRABILE, in anatomy, a ſmall plexus, or net-work of veſſels in the brain, ſurrounding the pituitary gland.

The rete mirabile is very conſpicuous in brutes, but either not exiſtent in man, or ſo very minute that its exiſtence is fairly doubted.

RETENTION is defined, by Mr. Locke, to be a faculty of the mind, whereby it keeps, or retains, thoſe ſimple ideas it has once received, by ſenſation or reflection.

RETENTION is alſo uſed, in medicine, &c. for the ſtate of contraction in the ſolids or vaſcular parts of the body, which makes them hold faſt their proper contents.

RETICENCY, *Reticentia*, a figure in rhetoric whereby we make oblique mention of a thing, in pretending to paſs it over unmentioned.

RETICULA, or RETICULE, in aſtronomy, a contrivance for the exact meaſuring the quantity of eclipſes.

The reticule is a little frame, conſiſting of thirteen fine ſilken threads, equidiſtant from each other, and parallel, placed in the focus of object glaſſes of teleſcopes; that is, in the place where the image of the luminary is painted in its full extent: of conſequence, therefore, the diameter of the ſun or moon is hereby ſeen divided into twelve equal parts or digits; ſo that to find the quantity of the eclipſe, there is nothing to do but to number the luminous and dark parts. As a ſquare reticule is only proper for the diameter, not for the circumference, of the luminary, it is ſometimes made circular by drawing ſix concentric equi-diſtant circles. This repreſents the phaſes of the eclipſe perfectly.

RETICULAR BODY, *Corpus reticulare*, in anatomy, a very fine membrane, perforated, in the manner of a net, with a multitude of foramina. It is placed immediately under

under the cuticle, and when that is ſeparated from the cutis, whether by art or by accident, this adheres firmly to it, and is ſcarce poſſible to be parted from it, ſeeming rather to be its inner ſuperficies than a diſtinct ſubſtance. In regard to this, we are to obſerve, firſt, the places in which it is found, being all thoſe in which the ſenſe of feeling is moſt acute, as in the palms of the hands, the extremities of the fingers, and on the ſoles of the feet. The tongue, however, is the part where it is moſt accurately to be obſerved: it is more eaſily diſtinguiſhable there than any where elſe, and its nature and ſtructure are moſt evidently ſeen there.

Its colour in the Europeans is white, but in the Negroes, and other black nations, it is black; in the tawny it is yellowiſh: the ſkin itſelf in both is white; and the blackneſs and yellowneſs depend altogether on the colour of this membrane.

The uſes of the corpus reticulare are to preſerve the ſtructure of the other parts of the integuments, and keep them in their determinate form and ſituation. Its apertures give paſſage to the hairs, and let through the papillæ and excretory ducts of the ſkin: it retains theſe in a certain and determinate order, that they cannot be removed out of their places, and has ſome ſhare in preſerving the ſoftneſs of the papillæ, which renders them fit for the ſenſe of feeling.

RETICULAR PLEXUS, *Plexus Reticularis*, ſometimes denotes the choroides, which is thus called becauſe its fibres are interwoven like a net.

RETICULUM, the caul or omentum, a name ſometimes given to this part, from its net-like ſtructure.

RETIFORMIS LACIS, in anatomy, the ſame with the rete mirabile. See RETE.

RETINA, in anatomy, the expanſion of the optic nerve on the internal ſurface of the eye, whereupon the images of objects being painted, are impreſſed, and by that means conveyed to the common ſenſory in the brain, where the mind views and contemplates their ideas.

RETINUE, *Retinentia*, the attendants or followers of a prince or perſon of quality, chiefly in a journey.

RETIRADE, in fortification, a kind of retrenchment made in the body of a baſtion, or other work, which is to be diſputed, inch by inch, after the defences are diſmantled. It uſually conſiſts of two faces, which make a re-entering angle. When a breach is made in a baſtion, the enemy may alſo make a retirade or new fortification behind it.

RETORT, in chemiſtry, a kind of crooked matraſs, or a round bellied veſſel, either of earth or glaſs, with a ſlender crooked beak, to which the recipient is to be placed. For the figure and method of uſing the retort, ſee DISTILLATION.

RETRACTION, *Retractio*, the act of drawing back, or unſaying what a perſon had ſaid before.

Among anatomiſts, retraction frequently ſignifies the contraction or ſhortening of any part.

RETRACTS, among horſemen, pricks in a horſe's feet, ariſing from the fault of the farrier in driving nails that are weak, or in driving them ill pointed, or otherwiſe amiſs.

RETRAHENS *Auriculum*, in anatomy, a muſcle of the external ear, conſiſting of a parcel of fleſhy fibres, which in ſome bodies are divided into diſtinct muſcles, ariſing from the os temporale, and fixed to the hind-part of the concha. But theſe muſcles are ſo ſmall in men that the auricle is ſeldom moveable at all.

RETREAT, in war, the retiring or moving back again of any army or part thereof.

RETREAT, in naval affairs, the order or diſpoſition in which a ſquadron of ſhips retires from a ſuperior or victorious enemy.

When a fleet is obliged to retreat in ſight of an enemy, the beſt way to ſecure it will be by ſailing in a kind of half moon; the admiral's ſhip forming the obtuſe angle, his fleet being equally divided, one half on the ſtar-board and the other half on the lar-board ſide; keeping the fire-ſhips, tranſports, &c. in the middle.

This manner of ranging a fleet ſeems the moſt adviſeable, becauſe the enemy can never approach thoſe who endeavour to eſcape without expoſing themſelves, at the ſame time, to the fire of the admiral, and that of his ſeconds.

If the commander in chief thinks this form gives too great an extent to his fleet, he may eaſily cloſe his wings or quarters.

The moſt natural courſe in this form of ſailing is to ſteer away before the wind: but, if neceſſary, the ſhips may bear away large upon either tack, or even keep cloſe upon a wind.

RETREAT, or RELAY, in maſonry, a little receſs or diminution of the thickneſs of a wall, rampart, &c. in proportion as it is raiſed. The retreat, properly, is the diminution of a wall without-ſide, or the contraction of its upper courſes more than the foundation. Where the foundation is very long, they uſually make two or three retreats.

RETRENCHMENT literally ſignifies ſomething cut off or taken from a thing; in which ſenſe it is the ſame with ſubtraction, diminution, &c.

RETRENCHMENT, in the art of war, any kind of work raiſed to cover a poſt, and fortify it againſt the enemy, ſuch as faſcines loaded with earth, gabions, barrels of earths, ſand-bags, and generally all things that can cover the men and ſtop the enemy. But retrenchment is more particularly applicable to a foſs bordered with a parapet; and a poſt fortified thus is called poſt retrenched, or ſtrong poſt.

Retrenchments are either general or particular: general retrenchments are new fortifications made in a place beſieged, to cover the beſiegers when the enemy become maſters of a lodgment on the fortification, that they may be in a condition of diſputing the ground inch by inch, and of putting a ſtop to the enemy's progreſs in expectation of relief.

Particular retrenchments are ſuch as are made in the baſtions when the enemy are maſters of the breach. Theſe can never be made but in new full baſtions, for in empty, or hollow ones, there can only be made retirades. The particular retrenchments are made ſeveral ways, according to the time they have to cover themſelves: ſometimes they are made before hand, which are certainly the beſt. The parapets of ſuch retrenchments ought to be five or ſix feet thick, and five feet high, with a large and deep foſs, from whence ought to run out ſmall fougades and countermines.

RETRIBUTION, *Retributio*, a handſome preſent, gratuity, or acknowledgment, given inſtead of a formal ſalary, or hire, to perſons employed in affairs that do not ſo immediately fall under eſtimation, nor within the ordinary commerce in money.

RETRIEVE, to recover, get again, or repair a thing loſt or damaged.

RETROCESSION, *Retroceſſio*, the act of going backwards; more uſually called retrogreſſion, or retrogradation. See the next article.

RETROCESSION *of the Equinox*. See the article PRECESSION.

RETROGRADATION, or RETROGRESSION, the act or effect of a thing moving backwards.

The retrograde motion of the planets is an apparent motion, whereby they ſeem, to an obſerver placed on the earth, to move backwards, or contrary to the ſigns.

The retrograde motion of the nodes, is a motion of the line of nodes, whereby it continually ſhifts its ſituation from eaſt to weſt, contrary to the order of the ſigns; completing its retrograde circulation in the compaſs of about nineteen years, after which time either of the nodes, having receded from any point of the ecliptic, returns to the ſame again.

RETROGRESSION *of Curves*, their bending or turning backwards. See the articles FLEXURE and INFLECTION.

RETROMINGENTS, in natural hiſtory, a claſs or diviſion of animals, whoſe characteriſtic it is that they ſtale, or make water backwards, both male and female.

RETURN, *Returna*, or *Retorna*, in law, is uſed in divers ſenſes. 1. Return of writs by ſheriffs and bailiffs is a certificate made by them to the court, of what they have done in relation to the execution of the writ directed to them. This is wrote on the back of the writ by the officer, who thus ſends the writ back to the court from whence it iſſued, in order that it may be filed. 2. Return of a commiſſion, is a certificate or anſwer ſent to the court from whence the commiſſion iſſues, concerning what has been done by the commiſſioners. 3. Returns, or days in bank, are certain days in each term, appointed for the return of writs, &c.

RETURN, in building, is a ſide or part that falls away from the fore-ſide of any ſtraight work.

RETURNS *of a Trench*, in fortification, are the turnings and windings which form the lines of a trench.

RETURNS *of a Mine*, in fortification, are the windings of the gallery.

REVE, REEVE, or GREVE, the bailiff of a franchiſe, or manor, thus called, eſpecially in the weſt of England. Hence ſhire-reve, ſheriff, port-greve, &c.

REVEILLE, a beat of drum about break of day, to give notice that it is time for the ſoldiers to ariſe, and that the centries are to forbear challenging.

REVELATION, the act of revealing, or making a thing public that was before unknown: it is alſo uſed for the diſcoveries made by God to his prophets, and by them to the world; and more particularly for the books of the Old and New Teſtament.

The principal teſts of the truth of any revelation are, its being worthy of God, and conſiſtent with his known attributes; its being agreeable to the clear dictates of unprejudiced reaſon, and its having a tendency to refine, purify, and exalt the mind of man to an imitation of the Deity in his moral perfections.

Mr. Locke, in laying down the diſtinct provinces of reaſon and faith, obſerves, 1. That the ſame truths may be diſcovered by revelation, which are diſcoverable to us by reaſon. 2. That no revelation can be admitted againſt the clear evidence of reaſon. 3. That there are many things of which we have but imperfect notions, or none at all; and others, of whoſe paſt, preſent, or future exiſtence, by the natural uſe of our faculties we cannot have the leaſt knowledge: and theſe, being beyond the diſcovery of our faculties, and above reaſon, when revealed, become the proper object of our faith. He then adds, that our reaſon is not injured or diſturbed, but aſſiſted and improved by new diſcoveries of truth coming from the fountain of knowledge.

Whatever God has revealed is certainly true: but whether it be a divine revelation or no, reaſon muſt judge, which can never permit the mind to reject a greater evidence to embrace what is leſs evident. There can be no evidence that any traditional revelation is of divine original, in the words we receive it, and the ſenſe we underſtand it, ſo clear and ſo certain, as that of the principles of reaſon: and, therefore, nothing that is contrary to the clear and ſelf-evident dictates of reaſon, has a right to be urged or aſſented to as a matter of faith, wherein reaſon has nothing to do. Whatſoever is divine revelation ought to over-rule all our opinions, prejudices, and intereſts, and has a right to be received with full aſſent: and ſuch a ſubmiſſion as this, of our reaſon to faith, takes not away the landmarks of knowledge.

REVELATION *of St. John*, the ſame with the apocalypſe. See APOCALYPSE.

REVELS, entertainments of dancing, maſking, acting, comedies, farces, &c. anciently very frequent in the inns of court, and in noblemen's houſes, but now much diſuſed. The officer who has the direction of the revels at court, is called the maſter of the revels.

REVENUE, the annual income a perſon receives from the rent of his lands, houſes, intereſt of money in the ſtocks, &c.

REVENUE, in hunting, a fleſhy lump formed chiefly of a cluſter of whitiſh worms on the heads of deer, ſuppoſed to occaſion their caſting their horns by gnawing them at the roots.

REVENUE is alſo uſed for a new tail of a partridge, growing after the lop of a former; this is meaſured by fingers; and thus they ſay a partridge of two, three, or four fingers revenue.

REVERBERATION, *Reverberatio*, in phyſics, the act of a body repelling or reflecting another after its impinging thereon.

REVERBERATION, in chemiſtry, denotes a kind of circulation of the flame by means of a reverberatory, or the return of the flame from the top of the furnace back to the bottom, chiefly uſed in calcination. Reverberation is of two kinds: the firſt with a cloſe fire, that is, a reverberatory furnace, where the flame has no vent a-top, being covered with a dome or capital, which repels its action back on the matter or the veſſel that contains it, with increaſed vehemence. After this manner is refining, the diſtillation of acids, ſpirits, &c. performed. Reverberation with an open fire is that performed in a furnace or reverberatory, whoſe regiſters are all open, uſed in calcination, &c. See the next article.

REVERBERATORY, or REVERBERATING FURNACE, a chemical furnace built cloſe all around, and covered at the top with a capital of brick or tiles, ſo as not to give any vent to the heat or flame, but to determine it to reverberate or turn back from the brick-work with new force upon the matter placed at bottom. When the fire has no vent or paſſage a-top, it is a whole reverberatory. When the middle of the capital is open, and only the ſides cloſe, ſo that there is only a half circulation of the flame, it is called an half reverberatory. The reverberatory furnace is chiefly uſed in the fuſion and calcination of metals and minerals, and on other occaſions where the moſt intenſe heat is required, as in aſſaying, &c. whence it is alſo called the melting furnace, and aſſaying furnace. See the article CHEMICAL LABORATORY.

REVEREND, *Reverendus*, a title of reſpect given to eccleſiaſtics.

REVERIE, the ſame with delirium, raving, or diſtraction. See DELIRIUM, &c.

It is uſed alſo for any ridiculous, extravagant imagination, action, or propoſition, a chimera or viſion. But the moſt ordinary uſe of the word, among Engliſh writers, is for a deep diſorderly muſing or meditation.

REVERSE, in law, &c. To reverſe ſignifies to undo, repeal, or make void.

REVERSE *of a Medal, Coin*, &c. denotes the ſecond or back-ſide, in oppoſition to the head or principal figure.

REVERSE, in fencing, a back ſtroke.

REVERSED, in heraldry, a thing turned backwards, or upſide down.

REVERSION, *Reverſio*, in law, is defined to be returning of lands, &c. into the poſſeſſion of the donor, or his heirs.

Reverſion, in the law of England, has two ſignifications; the one of which is an eſtate left, which continues during a particular eſtate in being; and the other is the returning of the land, &c. after the particular eſtate is ended; and it is further ſaid, to be an intereſt in lands, when the poſſeſſion of it fails, or where the eſtate which was for a time parted with, returns to the grantors, or their heirs. But, according to the uſual definition of a reverſion, it is the reſidue of an eſtate left in the grantor, after a particular eſtate granted away ceaſes, continuing in the grantor of ſuch an eſtate. The difference between a remainder and a reverſion, conſiſts in this, that the remainder may belong to any man except the grantor; whereas the reverſion returns to him who conveyed the lands, &c. See INTEREST.

REVERSION *of Series*, in algebra, a kind of reverſed operation of an infinite ſeries.

REVIEW, in chancery, is uſed for a bill, where a cauſe has been heard, and a decree thereon ſigned; but ſome error in law appearing upon the decree, or new matter being diſcovered after it was made, this bill is given for a freſh examination into the merits of the cauſe.

REVIEW, in war, is the appearance of an army, or part of an army, in order of battle, and their being viewed by the general, that he may know the condition of the troops, ſee that they are complete, and be a witneſs of the expertneſs with which they perform their evolutions and other exerciſes.

REVISE, among printers, a ſecond or third proof of a ſheet to be printed, taken off in order to be compared

with the laſt proof, to ſee whether all the miſtakes marked in it are corrected.

REVIVIFICATION, in chemiſtry, the ſame with reſuſcitation. See RESUSCITATION.

REVOLUTION, in politics, ſignifies a grand change or turn in government.

In geometry, the revolution of any figure, is its motion quite round a fixed line, as an axis.

The revolution of a planet, or comet, round the ſun is nothing but its courſe from any point of its orbit till its return to the ſame.

REVULSION, in medicine, turning a flux of humours from one part to another, by bleeding, cupping, friction, ſinapiſms, bliſters, fomentations, bathings, iſſues, ſetons, ſtrong purging of the bowels, &c. Dr. Van Swieten, in his Commentaries upon the Aphoriſms of Boerhaave, obſerves, that the uſe of revulſions in diſeaſes, is confirmed by daily experience as well as by reaſon; for ſo ſoon as the reſiſtence to the blood's motion is either diminiſhed or totally removed in any part of the body, it immediately flows into that part with a greater velocity.

RHABDOIDES, in anatomy, the ſame with the ſagittal ſuture of the ſkull.

RHABDOLOGY, in arithmetic, the doctrine of Neper's rods. See NEPER.

RHABDOMANCY, ραβδομαντεια, a ſpecies of divination performed by means of rods. See the article DIVINATION.

RHACHITIS, in medicine, the rickets. See the article RICKETS.

RHAGADES, in medicine, denotes chaps or clefts in any part of the body; ariſing either from an acidity of the parts, or acrimony of the humours; in both which caſes, cooling and emollient applications are proper.

RHAMNUS, in botany. See the articles ALATERNUS, JUJUBES, and BUCK-THORN.

RHAPONTICUM is the name for the root of the rheum. See RHEUM.

RHAPSODI, ραψωδοι, *Rhapſodiſts*, in antiquity, perſons who made a buſineſs of ſinging pieces of Homer's poems. Cuper informs us, that the Rhapſodi were cloathed in red when they ſung the Iliad, and in blue when they ſung the Odyſſee. They performed on the theatres, and ſometimes ſtrove for prizes in conteſts of poetry, ſinging, &c. After the two antagoniſts had finiſhed their parts, the two pieces or papers they were written in were joined together again: whence the name, viz. from ραπτω, *ſuo*, and ωδη, *canticum*: but there ſeems to have been other Rhapſodi of more antiquity than theſe people, who compoſed heroic poems or ſongs in praiſe of heroes and great men, and ſung their own compoſitions from town to town for a livelihood, of which profeſſion Homer himſelf is ſaid to be.

RHAPSODOMANCY, an ancient kind of divination performed by pitching on a paſſage of a poet at hazard, and reckoning on it as a prediction of what was to come to paſs.

RHAPSODY, ραψωδια, in antiquity, a diſcourſe in verſe ſung or rehearſed by a Rhapſodiſt. Others will have rhapſody to ſignify a collection of verſes, eſpecially thoſe of Homer, which having been a long time diſperſed in pieces and fragments, were at length, by Piſiſtratus's order, digeſted into books called rhapſodies, from ραπτω, *ſuo*, and ωδη, *canticum*. Hence, among moderns, rhapſody is alſo uſed for an aſſemblage of paſſages, thoughts, and authorities raked together from divers authors, to compoſe ſome new piece.

RHETORIANS, a ſect of heretics in Egypt, ſo denominated from Rhetorius their leader. The diſtinguiſhing doctrine of this hereſiarch, as repreſented by Philaſtrius, was, that he approved of all the hereſies before him, and taught that they were all in the right.

RHETORIC, *Rhetorica*, the art of ſpeaking copiouſly on any ſubject, with all the advantage of beauty and force.

Lord Bacon defines rhetoric very philoſophically, to be the art of applying and addreſſing the dictates of reaſon to the fancy, and of recommending them there ſo as to affect the will and deſires. The end of rhetoric, the ſame author obſerves, is to fill the imagination with ideas and images which may aſſiſt nature without oppreſſing it. Voſſius defines rhetoric, the faculty of diſcovering what every ſubject affords of uſe for perſuaſion. Hence, as every author muſt invent arguments to make his ſubject prevail, diſpoſe thoſe arguments, thus found out, in their proper places, and give them the embelliſhments of language proper to the ſubject; and if this diſcourſe be intended to be delivered in public, utter them with that decency and force which may ſtrike the hearer; rhetoric becomes divided into four parts, invention, diſpoſition, elocution, and pronunciation.

Rhetoric and oratory differ from each other as the theory from the practice; the rhetorician being he who deſcribes the rules of eloquence, and the orator he who uſes them to advantage. Ordinarily, however, the two are uſed indifferently for each other.

RHEUM, ρευμα, a thin ſerous humour, occaſionally ooſing out of the glands about the mouth and throat.

RHEUM, the RHAPHONTIC PLANT, in botany, a genus of plants, the corolla whereof conſiſts of a ſingle petal, which is narrow at the baſe and impervious: the limb is divided into ſix obtuſe ſegments, alternately ſmaller: there is no pericarpium: the ſeed is ſingle, large, triquetrous, acute, and ſurrounded with membranaceous rims.

The root of this plant, which appears evidently to have been the rhubarb of the ancients, is by many confounded with the modern rhubarb, though conſiderably different both in appearance and quality. The rhaphontic root is of a duſky colour on the ſurface, of a looſe ſpongy texture, conſiderably more aſtringent, but leſs purgative than the rhubarb; in this laſt intention two or three drams are required for a doſe. It is an ingredient in the Venice-treacle, and in ſome of the colder compoſitions of the ſhops, but in theſe rhubarb is generally uſed in its place.

RHEUMATISM, in medicine, a diſtemper that happens moſt commonly in ſpring or autumn, when there is a remarkable change of air from hot to cold, and from cold to hot, when the wind ſuddenly ſhifts to any oppoſite point. It begins, according to Sydenham, with a ſhivering and other ſymptoms of a fever, and in a day or two's time, or ſometimes ſooner, a vehement pain ſeizes one or more of the limbs, raging ſometimes in one place and ſometimes in another, eſpecially in the arms, wriſts, ſhoulders, and knees: very often there is a redneſs and ſwelling, and the fever gradually goes off while the pain remains. This diſtemper often runs out into a great length, continuing ſometimes for ſome months or years, not perpetually with the ſame violence, but coming and going, and from time to time renewing its paroxyſms.

It chiefly attacks perſons in the flower of their age, after violent exerciſe, or a great heat of the body from any other cauſe, and then being too ſuddenly cooled. Its proximate cauſe Boerhaave takes to be an inflammation of the lymphatic arteries of the membranes near the ligaments of the joints, but not ſo violent as to bring on a ſuppuration. This diſeaſe is nearly a-kin to the gout and ſcurvy, and the blood is like that of thoſe afflicted with the pleuriſy. The pain is exaſperated upon the leaſt motion: it ſometimes attacks the loins and coxendix, and ſometimes the brain, lungs, and viſcera: when it ſeizes the loins it is then called lumbago; in this caſe, Sydenham obſerves that there is a moſt violent pain in the ſmall of the back, which ſometimes extends to the os ſacrum, and is like a fit of the gravel, only the patient does not vomit. If this diſeaſe is unſkilfully treated, it may continue ſeveral months or years, but not always with the ſame violence, but by fits. If it continues and increaſes, it may cauſe a ſtiff joint, which will ſcarce yield to any remedy.

Sydenham directs to take away ten ounces of blood on the ſide affected; this muſt be repeated three or four times, or oftener, once every other or every third day, according as the ſtrength of the patient will bear. The diet muſt be very thin, and an emulſion of the four cold ſeeds may be given; as alſo a pultice of white-bread and milk, tinged with a little ſaffron, may be laid to the part affected; a clyſter of milk and ſugar may be injected on thoſe days the bleeding is omitted. If the patient cannot bear frequent bleeding, after the ſecond or third time give the

common

common purging potion every other day, and an ounce of diacodium at night, till he recovers.

In an incipient rheumatiſm of the ſhoulders, Hoffman ſays that nothing is better than a bliſter laid between the ſcapulæ; but if it happens to the plethoric, cupping, with ſcarification in the lower parts, repeated every month, does ſignal ſervice. The ſame phyſician thinks it may be proper to chew rhubarb, from two ſcruples to a dram, with raiſins or currants, two or three times a week.

The ſpirit of hartſhorn and the balſam of guaiacum, given in the quantity of twenty or thirty drops, three or four times a day, Dr. Shaw ſays, is of great ſervice: but he thinks nothing better than a decoction of the ſudorific woods, to the quantity of a quart a day, for a month or ſix weeks together. This laſt, when aſſiſted with crude antimony and mercurius dulcis, Hoffman recommends in the venereal rheumatiſm, which often ariſes from the remains of a lues venerea contained in the maſs of blood. In a ſcorbutic rheumatiſm, or that ariſing from the ſcurvy, Sydenham directs the patient to take the ſcorbutic electuary and water, if he cannot bear any kind of evacuation.

He obſerves, that young perſons who live temperately may be cured by a ſimple refrigerating diet, and moderate nouriſhing, with as much certainty as by repeated bleeding: for inſtance, let the patient live four days upon whey alone; and after that white-bread may be allowed for dinner, and on the laſt day of his illneſs he may be allowed it for ſupper. When the ſymptoms ceaſe he may have boiled chickens, or any thing of eaſy digeſtion, but every third day he muſt live upon whey only, till his ſtrength returns. Boerhaave's method of cure is to the ſame effect, only he adviſes warm baths and ſtrong bliſters to be laid upon the part affected, nay even cauteries themſelves: but Hoffman obſerves that great caution ſhould be uſed with regard to topics, for if the patient's conſtitution is ſanguineous they ſhould all be avoided, and the part covered carefully with the bed-cloaths; but if there is a thick, cold, ſtagnating humour in the part, and a ſenſe of cold, with a ſtricture of the pores, then frictions may be uſed with rough warm cloths, and afterwards cupping with ſcarifications. If the part becomes ſtiff and inflexible, with a numbneſs, which is called a pareſis, then take human or canine axungia, two ounces; balſam of Peru, and oil of cloves, each two drams; with which make a liniment for the part: this has been known to have a wonderful effect. Arbuthnot ſays that cream of tartar in water-gruel, taken for ſeveral days, will abate the pains and ſwellings conſiderably by its acidity, correcting the alkaline ſalts of the blood.

Cheyne ſays, that the hot and inflammatory rheumatiſms have all the ſymptoms of the gout, and like it, change from place to place, and by over violent evacuations may be tranſlated upon the noble organs.

RHEXIS, among oculiſts, denotes a rupure of the cornea of the eye.

RHINE LAND *Rod*, in fortification, &c. a meaſure of two fathoms, or twelve feet, uſed by the Dutch and German engineers, &c.

RHINOCEROS, in zoology, the name of a genus of quadrupeds; ſo called from an horn growing on their noſe.

Of this genus there are only two known ſpecies.
1. The rhinoceros with only one horn on its noſe; and,
2. The rhinoceros with two horns.

In the year 1739 we had a young rhinoceros ſhewn in England, of which Dr. Parſons has given a very accurate account in the Philoſophical Tranſactions.

The creature fed on rice, ſugar, and hay; his keeper uſed to mix the rice and ſugar in the following manner: ſeven pounds of rice and three pounds of ſugar made the proviſion for one day; he eat this at three meals: and beſides this, he eat about a truſs of hay every week, and a large quantity of greens that were brought to him, at different times, and of which he ſeemed more fond than of dried food. He drank often, and always was obſerved to ſwallow a large quantity of water at a time.

He appeared very peaceable in his temper, and bore to be handled on any part of his body with great patience, except when he was hungry; but he was then always outrageous, as alſo when he was ſtruck. His moſt violent paſſions, even on the laſt occaſion, were however always immediately appeaſed by giving him victuals.

Notwithſtanding the lumpiſh aſpect, and heavy make of this creature, he would jump about very nimbly in his fits of paſſion, and often leap to a great height; and one common mark of his fury was the ſtriking his head againſt the walls, or any thing elſe that was in the way, and this he would do with terrible violence. He was very apt to fall into theſe paſſions in a morning before his rice and ſugar were given him, and from the whole he appeared quite untractable, and ſeemed able, in his paſſions, to have run ſo faſt, as that a man on foot could not have eſcaped him.

This creature was two years old, and did not exceed a young heifer in height, but was remarkably broad and thick. His head was very large; and the hinder part of it, near the ears, remarkably elevated above the reſt of the face, which was flat, and ſunk down in a remarkable manner in the middle, riſing again towards the origin of the horn, but in a much ſmaller degree. The horn ſtands upon the noſe of the animal as upon a ſort of hill; and when the ſkeleton of the head is ſeen, that part of the ſkull on which the horn is fixed, is found to riſe into a blunt cone, to anſwer to a cavity in the baſis of the horn, which is very hard and ſolid; in other reſpects having no manner of hollow or core, like thoſe of other quadrupeds. The horn in this young animal did not riſe above an inch high from its tough baſis, and was black and ſmooth at the top, but ragged downwards; and the determination of its growth is backwards, not ſtraight up; this is very evidently ſeen in the horns of old rhinoceroſes, which are always curved in a conſiderable degree that way. If we conſider the proportion of this animal's ſize to the length of its horn, and thence carry the proportion to that between the large horns we ſee in the muſeums of the curious, we muſt ſuppoſe the animal of a very ſtupendous ſize, when at its full growth. *Phil. Tranſ.* N°. 470.

The ſides of the under jaw, in this creature, ſtand very wide aſunder, ſlanting outwards to the lower edge, and backwards to the neck; the edges turn outwards from this ſtructure of the bones, and the head neceſſarily looks very large. That part of the head which reaches from the fore part of the horn to the upper lip may be called the noſe; this is very thick and bulky, and has a kind of circular ſweep down towards the noſtrils; on all this part there are a great number of rugæ or wrinkles.

The noſtrils are ſituated very low, in the ſame direction with the opening of the mouth, and not more than an inch from it; and when viewed in a fore-view, the whole noſe, from the top of the horn to the verge of the lower lip, is ſhaped like a bell. The under lip is like that of an ox, but the upper more like that of a horſe, and he uſes it as that creature does, to gather up hay from the rack, or graſs from the ground; but with this ſuperior advantage, that this creature has a power of extending this lip to ſix or ſeven inches in length from the noſe, and there drawing it to a point; with this lip, thus extended, the creature is able to graſp a ſtick, or any ſmall ſubſtance, and hold it extremely faſt; and this power of prolonging the lips ſerves, in many purpoſes, to the ſame end as the trunk of that other unwieldy animal the elephant.

The tongue of the rhinoceros is ſaid to be ſo rough as to be able to rub a man's fleſh off from the bones; but in this young ſubject it was ſo ſoft, that it reſembled that of a calf. It may poſſibly grow harder with age; but the ſtory of its effects ſeems of a piece with the many other falſe marvels reported of this animal. The eyes are dull and ſleepy, much like thoſe of a hog in ſhape; he ſeldom opens them entirely; and it is to be obſerved, that they are ſituated nearer the noſe than thoſe of any other known quadruped. The ears are broad and thin towards the top, much like thoſe of a hog; but they ariſe each from a narrow round baſe, with ſome wrinkles on it, which iſſues out of a ſinus as it were ſurrounded with a fleſhy fold. The neck is very ſhort, and has two folds or wrinkles, wholly ſurrounding it, only that the anterior one is broken underneath; and has a flap hanging from it ſo deep, that it would contain a man's hand; from the middle

middle of the poſterior plica of the neck, there ariſes another, which paſſing backward, is loſt before it reaches the body. The ſhoulders are thick and heavy, and have each a fold paſſing downwards. The body is very large and thick, and ſtands out at the ſides like that of a cow with calf. The legs are very thick and ſtrong; they are round, and ſomewhat ſmaller downwards than in the upper part; and when the creature ſtands upright, they bend inwards at the knee, ſo that they are nothing like ſtraight. In ſome quadrupeds the fetlock bends to the weight of the animal, but in this creature there is no appearance of any ſuch bending, ſo that he ſeems to ſtand upon four ſtumps, eſpecially when viewed behind. He has three hoofs upon each foot forward, but the back part is a great maſs of fleſh, rough like the reſt of the ſkin; and the ſole of the foot is very plump and callous in the ſurface, but eaſily yielding to the preſſure from the ſoftneſs of the ſubjacent fleſh. Its ſhape is like that of a heart, with a blunt apex before, and a broad baſe behind. The tail is very ſmall in proportion to the ſize of the animal, not exceeding ſeventeen or eighteen inches in length, and but thin or ſlender; it is very rough, and has a kind of twiſt or ſtricture towards the extremities, ending in a flat maſs; this gave occaſion to ſome authors to compare the whole tail to a ſpatula; on the ſides of this flat part, there grew a few ſhort but very thick and ſtrong black hairs, but theſe grow much longer in the more advanced ſtate of the creature; and are not round, like other hairs, but flat, like ſmall pieces of whalebone. The creature has no other hair about it, except a very ſmall quantity at the edge of the ears.

The penis of the male rhinoceros is of a very remarkable ſtructure, being incloſed in two caſes. The female differs in nothing from the male except in the pudenda, which are ſhaped like thoſe of a cow.

The ſkin of the rhinoceros is thick, and ſeems almoſt impenetrable; it feels like a piece of board of half an inch thick. It is covered in all parts, more or leſs, with a ſort of incruſtations reſembling ſcales. Theſe are ſmall on the neck, and largeſt of all in the ſhoulders and hips; between the folds of this thick ſkin, the cuticle, which is left bare, is ſoft, and eaſily penetrable. The ſcabby incruſtations of the ſkin have been called ſcales, by ſome writers; but this is a very wrong term, for they have nothing of the nature of ſcales, nor any thing of regularity in them.

The creature is of the retromingent, and therefore probably of the retrogenerative kind; the penis, when erect, is not more than nine, or at the utmoſt ten inches long, and is curved backwards at the end. This was the deſcription of the rhinoceros ſhewn in England at this time, and of all the others that have been ſeen in this part of the world, as to the general characters; but tho' theſe creatures which we have ſeen, have but one horn, it is very certain that there is a ſpecies of rhinoceros which has two. Martial has mentioned a rhinoceros, as ſhewn in the amphitheatre at Rome, which had two horns; but his commentators, ſuppoſing the copies erroneous, have been at great pains to alter it, ſo as to make it expreſs what they had ſeen or heard of, that is, a rhinoceros only with one horn; but it appears from almoſt indiſputable teſtimony, that there not only is in nature ſuch a rhinoceros with two horns, but that ſuch were ſhewn in the public ſports at Rome, and therefore the text ſeems to have been very right, and the commentators in the wrong. The creatures we have ſeen have indeed only had one horn; and the accounts of travellers, and the great number of horns preſerved in the cabinets of the curious, which are all ſingle, ſeem to prove this; but, though the rhinoceroſes of Aſia are all one-horned, yet it is certain, that there is a kind found in Africa which has two horns, and it is known, that the Romans had beaſts from this laſt part of the world as well as the other. Peter Kolbe, in his Voyage to the Cape of Good-Hope, deſcribes rhinoceroſes which he ſaw, and which had a horn on the noſe, and another cloſe behind it. Sir Hans Sloane's muſeum affords two horns of a rhinoceros, ſtanding juſt as this author has deſcribed them, which are ſtill fixed to the ſame integument; and we are convinced of the Romans being acquainted with this ſpecies, from a braſs medal of Domitian, which has on it a rhinoceros, with two horns on the noſe placed in this manner.

Redi, who has been very ſagacious in diſcovering the falſity of many of the pretended medicines taken from animals, yet gives us on the teſtimony of his own experience, an account of ſome very remarkable virtues in the parts of the rhinoceros. The blood he aſſures us is excellent in cholics and dyſenteries. The decoction of the ſkin, he aſſures us, is a grand ſtomachic antidote; and the horns are very valuable and alexipharmic.

RHODIUM, or Rosewood, the wood or root of a tree, of which we have no certain account; brought from the Canary iſlands, in long crooked pieces, full of knots, externally of a whitiſh colour, internally of a deep yellow, with a reddiſh caſt. The largeſt, ſmootheſt, ſtraighteſt, heavieſt, and deepeſt-coloured pieces ſhould be choſen; and the ſmall, thin, pale, light ones rejected.

This wood has a ſlightly bitteriſh, ſomewhat pungent, balſamic taſte, and a fragrant ſmell, eſpecially when ſcraped or rubbed, reſembling that of roſes. Digeſted in rectified ſpirit, it gives out pretty readily the whole of its active matter, and tinges the menſtruum of a reddiſh yellow colour: on committing to diſtillation the filtered tincture, the ſpirit brings over little or nothing of its flavour; the fine ſmell, as well as the balſamic pungency, of the rhodium, remaining nearly entire in the inſpiſſated extract, which proves tenacious and adheſive like the turpentines. Infuſed in water, it gives out likewiſe great part of its ſmell and taſte, together with a bright yellow colour: in evaporation, the water carries off the ſpecific flavour of the wood, leaving in the extract only a ſlight pungency and bitteriſhneſs. Diſtilled with water, it gives over, ſomewhat difficultly and ſlowly, a highly odoriferous eſſential oil, at firſt of a gold colour, by age turning reddiſh; amounting, if the rhodium is of a good kind, to about one ounce from fifty: the diſtilled water is likewiſe agreeably impregnated with the fragrance of the rhodium, and greatly reſembles that of damaſk roſes.

The eſſential oil is uſed as a perfume, for ſcenting pomatums, &c. and in this light only the rhodium wood is generally regarded. It promiſes, however, to be applicable to more important purpoſes, and bids fair to prove a valuable cordial and corroborant.

Jamaica affords a wood called by the people there roſe-wood; which, though not the rhodium of the ſhops, has nevertheleſs much of the ſmell: it is deſcribed by Sir Hans Sloane to be a tree growing to twenty or more feet in height, and thick enough to afford the largeſt ſegments we ever meet with of it; and poſſibly an adulteration of the true rhodium with this wood may be the true cauſe why the rhodium is not allowed to be the root, but a ſpecies of cytiſus, as Hoffman affirms.

The flowers of the Jamaica roſe-wood are ſmall and white, conſiſting of three petals, and ſtanding in cluſters: the fruit is a berry of the ſize of a pepper-corn, and the leaves of the tree are pinnated.

RHOMBOIDES, in geometry, a quadrilateral figure, whoſe oppoſite ſides and angles are equal, but is neither equilateral nor equiangular.

Rhomboides, in anatomy, a thin, broad, and obliquely ſquare fleſhy muſcle, ſituated between the baſis of the ſcapula and the ſpina dorſi; ſo called from its figure. Its general uſe is to draw, backward and upward, the ſubſpinal portion of the baſis ſcapulæ.

RHOMBUS, in geometry, an oblique-angled parallelogram, or quadrilateral figure, whoſe ſides are equal and parallel, but the angles unequal, two of the oppoſite ones being obtuſe, and the other two acute.

RHUBARB, *Rhabarbarum*, a plant with large dock-like leaves, among which ariſes a ſingle thick ſtalk, bearing looſe cluſters of naked monopetalous bell ſhaped white flowers; each of which contains nine ſtamina, of which the docks, ſtrictly ſo called, have but ſix, and is followed by a triangular ſeed ſurrounded about the edges with a leafy margin. It is perennial. It is a native of China and Siberia, and has lately been raiſed in ſome of our gardens, where it is found to grow with vigour in the open ground.

Two ſorts of rhubarb roots are met with in the ſhops. The firſt is imported from Turkey and Ruſſia, in roundiſh pieces, freed from the bark, with a hole through the middle of each, externally of a yellow colour, internally variegated with lively reddiſh ſtreaks. The other, which is leſs eſteemed, comes immediately from the Eaſt Indies, in longiſh pieces, harder, heavier, and more compact than the foregoing. The firſt ſort, unleſs kept very dry, is apt to grow mouldy and worm-eaten: the ſ-cond is leſs ſubject to theſe inconveniencies. Some of the more induſtrious artiſts are ſaid to fill up the worm holes with certain mixtures, and to colour the outſide of the damaged pieces with powder of the finer ſorts of rhubarb, and ſometimes with cheaper materials. The marks of the goodneſs of rhubarb are, the livelineſs of its colour when cut; its being firm and ſolid, but not flinty or hard; its being eaſily pulverable, and appearing when powdered of a fine bright yellow colour; its imparting to the ſpittle, on being chewed, a deep ſaffron tinge; and not proving ſlimy or mucilaginous in the mouth. Its taſte is ſubacrid, bitteriſh, and ſomewhat ſtyptic; the ſmell, lightly aromatic.

Rhubarb is a mild cathartic, and commonly looked upon as one of the ſafeſt and moſt innocent of the ſubſtances of this claſs. Beſides its purgative virtue, it has a mild aſtringent one, diſcoverable by the taſte, and by its ſtriking an inky blackneſs with chalybeate ſolutions: hence it is found to ſtrengthen the tone of the ſtomach and inteſtines, to leave the belly coſtive, and to be one of the moſt uſeful purgatives in diarrhæas, dyſenteries, and all diſorders proceeding from a debility and laxity of the fibres: it is frequently indeed given with a view rather to this ſtomachic corroborating virtue, than to its producing any conſiderable evacuation. It tinges the urine of a light yellow colour.

Rhubarb in ſubſtance purges more effectually than any preparation of it: the doſe is from a ſcruple to a dram. By roaſting it with a gentle heat, till it becomes eaſily friable, its cathartic power is diminiſhed, and its aſtringency ſuppoſed to be increaſed. In its habitude to menſtrua, it differs remarkably from moſt of the other cathartic drugs, its purgative virtue being extracted far more perfectly by water than by rectified ſpirit: the root remaining after the action of water is almoſt, if not wholly, inactive; whereas, after repeated digeſtion in ſpirit, it proves ſtill very conſiderably purgative: the colour of both tinctures is a fine deep yellow, that of the ſpirituous paleſt; when the rhubarb has given out to ſpirit all that this menſtruum can extract, it ſtill imparts a deep colour, as well as a purgative impregnation, to water. The watery infuſion, in being inſpiſſated by a gentle heat, has its virtue ſo much diminiſhed, that a dram of the extract is ſaid to have ſcarcely any greater effect than a ſcruple of the root in ſubſtance: the ſpirituous tincture loſes leſs; half a dram of this extract proving moderately purgative, though ſcarcely more ſo than an equal quantity of the powder. The ſpirituous extract diſſolves almoſt wholly in water; and hence the tincture does not, like the ſpirituous infuſions of moſt other vegetables, turn milky on being mixed with aqueous liquors: of the watery extract, ſcarce above one fourth is diſſolved by rectified ſpirit, and the part that does not diſſolve proves more purgative than that which does.

Tinctures of this root are drawn in the ſhops with proof ſpirit and with mountain wine, in the proportion of an ounce of the rhubarb to a pint of the menſtruum. Theſe preparations, uſed chiefly as mildly laxative corroborants, in weakneſs of the ſtomachs, indigeſtion, diarrhæas, cholicky, and other like complaints, are commonly aromatized with a little cardamom ſeeds and ſaffron, as two drams of the former and one of the latter to the above quantity of the root. For ſome purpoſes, a tincture is drawn from the rhubarb and cardamom ſeeds with proof ſpirit, and two ounces of white ſugar-candy diſſolved in the ſtrained liquor. For others, inſtead of ſweets and aromatics, gentian and ſnake root are joined, in the proportion of a dram and a half of the former and a dram of the latter, with the addition of a ſcruple of cochineal as a colouring ingredient: this laſt tincture is, in many caſes, an uſeful aſſiſtant to the Peruvian bark in the cure of intermittents.

The Turky rhubarb is, among us, univerſally preferred to the Eaſt India ſort, though this laſt appears to be for ſome purpoſes at leaſt equal to the other. It is manifeſtly more aſtringent, but has ſomewhat leſs of an aromatic flavour. Tinctures made from both with equal quantities of rectified ſpirit, have nearly the ſame taſte: on drawing off the menſtrua, the extract left by the tincture of the Eaſt India rhubarb proves in taſte conſiderably ſtronger than the other. Both ſorts appear to be the produce of the ſame climate, and the roots of the ſame ſpecies of plant, taken up probably at a different ſeaſon, or cured in a different manner.

RHUMB, in navigation, a vertical circle of any place, or the interſection of ſuch a circle with the horizon. Therefore, rhumbs coincide with the points of the world, or of the horizon; and hence navigators diſtinguiſh the rhumbs by the ſame name as the points and winds. See COMPASS.

RHUMB LINE, in navigation, the line which a ſhip deſcribes, keeping in the ſame collateral point or rhumb. See COURSE.

RHYME, in poetry, a ſimilitude of ſound between the laſt ſyllable or ſyllables of two verſes. Rhymes may be diſtinguiſhed into whole or perfect, and half or imperfect rhymes. The firſt is where there is a ſimilitude of ſound without any difference, the latter where there is a difference either in the pronunciation or orthography. The French diſtinguiſh their rhymes into maſculine and feminine. The feminine is where the laſt ſyllable of the rhyme ends with an *e* mute, in as *dove*, *belle*, &c. The maſculine rhymes are thoſe of all other words.

Rhyme is a modern invention, the product of a Gothic age. Milton calls it the modern bondage, yet ſome authors will have it that the Engliſh, French, &c. borrow their rhyme from the Greeks and Latins, who affected a certain cadence or period ending in a conſonant. This affectation increaſed, as the Latin tongue declined; ſo that among the Latin writers ſcarce any thing is more common than rhyming periods. In the twelfth century, particularly, Latin rhyme was much in vogue, under the name of Leonine verſes. The French, and from them the Engliſh, retain this cadence of rhyme, which ſeemed more agreeable than the meaſured verſes of the Greek and Roman poets. The reader may ſee a collection of Latin rhymes of our ancient Engliſh writers, in Cambden's Works. Since the reſtoration of learning in the ſixteenth century, attempts have been made to baniſh rhyme from the modern poetry, and to ſettle the Engliſh and French verſes on the footing of the ancient Greek and Latin ones, by fixing the quantity of the ſyllables, and truſting wholly to thoſe and the numbers, or meaſure. Milton, Philips, Addiſon, Thomſon, and ſome others, have excelled in this ſort of blank verſe. The French have attempted the ſame, but not ſucceeded; this kind of meaſure being inconſiſtent with the genius of the French tongue, which cannot vary the arrangement of the words, or change their ſituation, as this kind of verſe requires. Nor indeed can any of the modern tongues equal the ancient in this reſpect; yet none more than the Engliſh, nor leſs than the French. *Dict. Trevoux.*

RHYTHM, or RHYTHMUS, in muſic, the variety in the movement as to the quickneſs or ſlowneſs, length or ſhortneſs of the notes.

Or rhythmus may be defined, more generally, the proportion which the parts of a motion have to each other.

Ariſtides, among the ancient muſicians, applies the word rhythmus three ways, viz. either to immoveable bodies when their parts are rightly proportioned to each other, as a well-made ſtatue, &c. or to things that move regularly, as handſome walking, in dancing, in the dumb ſhews of pantomimes, &c. or, thirdly, to the motion of ſound or voice; in which the rhythmus conſiſts of long and ſhort ſyllables, or notes, joined together in ſome kind or order, ſo as their cadence on the ear may be agreeable.

The rhythmus of the ancients was very different, as Mr. Malcolm obſerves, from that of the moderns; the former depended altogether on the poetry, and was only that of the long and ſhort ſyllables of the words and verſes,

and had no other forms or varieties than what the material art afforded. The changes therein are none but thoſe made from one kind of metrum to another, as from iambic to choraic.

In the modern muſic, the conſtitution of the rhythmus differs from that of the verſe ſo far, that, in ſetting muſic to words, the thing chiefly regarded is to accommodate the long and ſhort notes to the ſyllables, in ſuch a manner as that the words be well ſeparated, and the accented ſyllables of each word ſo conſpicuous, that what is ſung may be diſtinctly underſtood.

Pancirollus ſeems of this opinion, and the reaſon he gives why the modern muſic is leſs perfect than the ancient, is, that we hear ſounds without words.

Voſſius adds, that the modern languages and verſes are altogether unfit for muſic; and that we never ſhall have any right vocal muſic, till our poets learn to make verſes capable to be ſung, that is, till we new model our language, reſtore the ancient quantities and metrical feet, and baniſh our barbarous rhymes. Our verſes, ſays he, run, as it were, all in one foot, ſo that we have not any real rhythmus at all in our poetry: he adds, that we mind nothing farther than to have ſuch a number of ſyllables in a verſe of whatſoever order; but this exaggeration in ſome reſpects is unjuſt.

RHYTHMICA, in the ancient muſic, that which conſidered the motions, regulated the meaſure, order, mixture, &c. ſo as to excite the paſſions, keep them up, augment, diminiſh, or allay them.

Ariſtides and other ancient muſical writers divided artificial muſic into harmonica, rhythmica, and metrica.

But the rhythmica with them likewiſe comprehended dumb motions, and, in effect, all rhythmical, that is, regular motion.

RIAL, or RYAL, a Spaniſh ſilver coin. See EXCHANGE.

RIAL, or ROYAL, is alſo the name of a piece of gold anciently current among us for ten ſhillings.

RIBBAN, or RIBBON, in heraldry, the eighth part of bend.

RIBBAND, or RIBBON, a narrow ſort of ſilk, chiefly uſed for head ornaments, badges of chivalry, &c.

In order to give our readers an idea of the manner in which this curious and valuable branch of manufacture is managed, we ſhall preſent him with a view of the ribbon-weaver in his loom, as repreſented in plate CIX. *fig.* 11. where 1 is the frame of the loom. 2. The caſtle, containing forty-eight pullies. 3. The branches, on which the pullies turn. 4. The tires, or the riding cords, which run on the pullies, and pull up the high-liſſes. 5. The liſt-ſticks, to which the high-liſſes are tied. 6. The high-liſſes, or liſts, are a number of long threads, with platines, or plate-leads, at the bottom; and ringlets, or loops, about their middle, through which the cords or croſs-threads of the ground-harneſs ride. 7. The plate-leads, or platines, are flat pieces of lead, of about ſix inches long, and three or four broad at the top, but round at the bottom; ſome uſe black ſlates inſtead of them: their uſe is to pull down thoſe liſſes, which the workman had raiſed by the treddle, after his foot is taken off. 8. The branches or cords of the ground harneſs, which go through the loops in the middle of the high-liſſes: on the well ordering of theſe cords chiefly depends the art of ribbon-weaving, becauſe it is by means of this contrivance that the weaver draws in the thread or ſilk that makes the flower, and rejects or excludes the reſt. 9. The batton; this is the wooden frame that holds the reed, or ſhuttle, and beats or cloſes the work: where obſerve, that the ribbon-weaver does not beat his work; but as ſoon as the ſhuttle is paſſed, and his hand is taken away, the batton is forced by a ſpring from the top, to beat the work cloſe. 10. The ſhuttle, or reed. 11. The ſpring of the batton, by which it is made to cloſe the work. 12. The long-harneſs are the front-reeds, by which the figure is raiſed. 13. The linguas are the long pieces of round or ſquare lead, tied to the end of each thread of the long harneſs, to keep them tight. 14. The broad piece of wood, about a foot ſquare, leaning ſomewhat forward, intended to eaſe the weaver, as he ſtoops to his ſhuttle; it is fixed in the middle of the breaſt-beam. Some weavers, inſtead of this, have a contrivance of a cord or rope, that is faſtened to the front-frame, and comes acroſs his breaſt; this is called a ſlop-fall. 15. The ſeat-bench; this leans forwards very much. 16. The foot-ſtep to the treddles. 17. The breaſt-beam, being a croſs-bar that paſſes from one of the ſtandards to the other, ſo as to front the workman's breaſt; to this breaſt-bar is fixed a roll, upon which the ribband paſſes in its way to be rolled upon the roller, that turns a little below. 18. The clamps, or pieces of wood, in which the broaches, that confine the treddles, reſt. 19. The treddles are long narrow pieces of wood, to the ends of which the cords, that moves the liſſes, are faſtened. 20. The treddle-cords are only diſtinguiſhed from the riding cords by a board full of holes, which divide them, in order to prevent the plate-leads, which are tied to the high-liſſes, from pulling them too high, when the workman's foot is off the treddle: which ſtop is made by a knot in the treddle-cord, too big to be forced through that hole in the board. 21. The lames are two pieces of thin narrow boards, only uſed in plain works, and then to ſupply the place of the long-harneſs. 22. The knee-roll, by which the weaver rolls up his ribbon, as he ſees proper, or by bit and bit, as it is finiſhed. 23. The back-rolls, on which the warp is rolled. It is to be obſerved, that there are always as many rolls as colours in the work to be wove. 24. The clamps, which ſupport the rollers. 25. The returning ſticks, or, as others call them, the returns, or the tumblers, or pullies, to which the tires are tied, to clear the courſe of cords through the high-liſſes. 26. The catch-board, for the tumblers. 27. The tire-board. 28. The buttons for the knee-rolls and treddle-board, deſcribed in number 20.

Ribbons of all ſorts are prohibited to be imported.

RIBBANDS, in ſhip-building, certain thin narrow planks, which are ſo made, that they may be eaſily bent to the timbers. That which is nailed to the ſtern-poſt at the height of the riſing line, and to the mid ſhip-frame at the end of the riſing of the floor-timbers, is called the floor ribband. That which anſwers to the wing-tranſom, and to the height of the lower deck on the mid-ſhip-frame, is called the breadth ribband: all the reſt between theſe two are called intermediate ones.

Theſe ribbands are nailed to all the frames from the ſtern-poſt to the ſtem, and when they are carried round, ſo as to make fair curves, the form of all the filling timbers may by them be determined. *Du Hamel's Naval Architecture.*

RIBS, *Coſtæ*, in anatomy, long arched bones, ſerving to ſuſtain the inner ſides of the thorax.

The ribs are twenty-four in number, viz. twelve on each ſide the twelve vertebræ of the back; they are crooked, and like to the ſegments of a circle; they grow flat and broad, as they approach to the ſternum; but the nearer they are to the vertebræ, they are the rounder and thicker; at which end they have a round head, which, being covered with a cartilage, is received into the ſinus in the bodies of the vertebræ; and at the neck of each head, except the two laſt ribs, there is a ſmall tubercle, which is alſo received into the ſinus of the tranſverſe proceſſes of the ſame vertebræ. The ribs, thus articulated, make an acute angle with the lower vertebræ. The ribs have each a ſmall canal or ſinus, which runs along their under ſides, in which lies a nerve, vein, and artery. Their extremities, which are faſtened to the ſternum, are cartilaginous, and the cartilages make an obtuſe angle with the bony part of the ribs: this angle reſpects the head. The cartilages are harder in women than in men, that they may better bear the weight of their breaſts. The ribs are of two ſorts; the ſeven upper ones are called *coſtæ veræ*, becauſe their cartilaginous ends are received into the ſinus of the ſternum; the five lower are called *falſæ*, becauſe they are ſofter and ſhorter, of which only the firſt is joined to the extremity of the ſternum, the cartilaginous extremities of the reſt being tied to one another, and thereby leaving a greater ſpace for the dilation of the ſtomach and entrails. The laſt of theſe falſe ribs is ſhorter than all the reſt; it is not tied to them, but ſometimes to the muſculus obliquus deſcendens. If

the

the ribs had been articulated with the bodies of the vertebræ at right angles, the cavity of the thorax could never have been enlarged in breathing. If each rib had been a rigid bone articulated to the tranſverſe proceſſes of the vertebræ, the ſternum could not have been thruſt out to that degree that it is now, or the cavity of the thorax could not have increaſed ſo much as is requiſite in inſpiration; for, when the ribs are pulled up by the intercoſtal muſcle, the angles which the cartilages at the ſternum make with the bony part of the rib, muſt be increaſed, and conſequently its ſubſtance, or the diſtance between the ſternum and the tranſverſe proceſſes, lengthened. Now becauſe the rib cannot move beyond the tranſverſe proceſs, upon the account of its articulation with it, therefore the ſternum muſt be either thruſt to the other ſide, becauſe of an equal preſſure upon the ſame account there; and therefore it is thruſt outwards, or the diſtance between the ſternum and vertebræ is increaſed. The laſt ribs which do not reach the ſternum, and conſequently produce nothing in this action, are not articulated with the tranſverſe proceſſes.

RIBS *of a Ship*, a figurative expreſſion which implies the timbers. See the article TIMBER.

RIBS *of a Parrel*. See the article PARREL.

RICE, *Oryſa*, in botany, &c. See the article ORYZA.

RICKETS, *Rhachitis*, in medicine, a diſorder incident to children, proceeding from an unequal nutrition.

Children are ſeldom attacked with rickets before they are nine months old, and after they are two years old. It may originally proceed from the diſorders of the parents, and may be increaſed by thoſe of the nurſe. It is alſo promoted by feeding the child with aqueous and mucous ſubſtances, crude ſummer fruits, fiſh, and too great a quantity of ſweet things; by ſitting too much, eſpecially in a perforat-chair, with its coats up; by a ſtriking in of the itch, &c.

This diſorder is known from a flaccid tumour of the head and face, a flabby looſe ſkin, a ſwelling of the belly, and a falling away of the reſt of the other parts, eſpecially of the muſcles; from protuberances of the apophyſes of the joints, ſuch as the wriſts, ancles, and knees; from the largeneſs of the jugular veins and arteries, while the reſt decreaſe; from knotty ribs, a narrow breaſt, and carious teeth, &c.

The cure, according to Boerhaave, is to be attempted with light, nouriſhing, dry aliment; not fat, but ſeaſoned, and taken often; with little ſound drink, ſuch as mild beer, or ale; with a dry warm air, and warm woollen cloathing; with being carried about in the arms, or drawn in a vehicle over the ſtones, and often ſhook, ſwung, and put in motion; with repeated frictions, eſpecially of the belly and ſpine of the back with warm dry flannel, ſprinkled with aromatics; with gentle emetics frequently though prudently repeated; with ſtrengthening purges for ſeveral days ſucceſſively; and with cold bathing, the child being put to ſweat between blankets every day, as ſoon as he comes out of the water.

Particularly for food, the bread ſhould be biſcuit, with a little ſaffron and ſpices; the fleſh ſhould be pigeons, pullets, veal, rabbits, mutton gently roaſted, minced and mixed with biſcuit, ſalt, a little parſley, thyme, nutmeg, or the like. He may alſo eat rice, millet, or pearl-barley, boiled with raiſins, to which add a little wine, of which an ounce may be given three or four times a day; as alſo Brunſwic mum and Engliſh beer, which in the ſummer may be mixed with ſpaw-water. Let the pillow and bed be filled with the following leaves dried in the ſhade, viz. of malefern, three pounds; of marjoram, baum, and mint, each two handfuls; and of the flowers of melilot, ſweet trefoil, elder, and roſes, dried in the ſhade, of each two ounces: reduce them all to powder, and mix them with double the quantity of barley-chaff.

RIDEAU, in fortification, a ſmall elevation of earth, extending itſelf lengthwiſe on a plain, ſerving to cover a camp, or give an advantage to a poſt.

The word is French, and ſignifies, literally, a curtain, or cover.

Rideau is alſo uſed for a trench, the earth of which is thrown up on its ſides to ſerve as a parapet for covering the men.

RIDGE, in building, the higheſt part of the roof, or covering of a houſe, &c.

RIDGE, in agriculture, a long piece of riſing land, between two furrows.

The method of plowing land up into ridges is a particular ſort of tillage. The chief uſe of it conſiſts in the alteration it makes in the degrees of heat and moiſture; theſe being two of the grand requiſites of vegetation, and very different degrees of them being requiſite to the different ſorts of plants. Thoſe plants commonly ſown in our fields require a moderate degree of both, not being able to live upon the ſides of perpendicular walls in hot countries, nor under the water in cold ones, neither are they amphibious; but they muſt have a ſurface of earth, not covered, nor much ſoaked with water, which deprives them of a proper degree of heat, and cauſes them to languiſh. In this caſe they look weak, and their leaves yellowiſh. They ceaſe growing, and, in fine, die in a very weak and bad ſtate. The only way to cure the land of giving this diſeaſe to plants, is to lay it up in ridges, that the water may fall off, and run into the furrows below, from whence it may be conveyed by drains and ditches into ſome river, or otherways carried wholly off from the land.

The more any ſoil is filled with water, the leſs heat it will have. The two ſorts of land moſt liable to be overglutted with water are hills, the upper ſtratum of mould in which lies on clay; and, generally, all deep and ſtrong lands. Hills are made wet and ſpewy by the wet that falls in rain, dews, and miſts; and this wet, not being able to ſink through the clay, in theſe ſoils, runs down between it and the mould; but extending itſelf through the mould all the way, and making it continually waſhy. The plowing this ſort of land in ridges, made from the higher to the lower part of the field, is of no benefit; for the water will preſs from below upwards in theſe ridges, being forced by the addition of freſh ſupplies above.

There are two methods of draining a hill ground like this. The one is to dig ſeveral deep trenches croſs-wiſe, or horizontally on the ſides of the hill: let theſe be nearly filled up with ſhores, and the ſurface covered in the common method: the wet will be received into theſe in all parts, and diſcharged at the ends; and the plough will go over the ſtones, without ſtriking through the depth of earth that covers them. Thus, the land will be dried for a time; but, as theſe channels fill up with earth, between the ſtones, they become of no uſe, and the expence of making new ones is very great.

The other way is to plow the land in ridges almoſt horizontally, and then the furrows between them are ſo many drains, carrying off the water at their lower ends; if the plough is made to ſtrike a few inches deep into the clay, and the ends of the furrows are no higher than the other parts: every furrow will be a drain to every ridge, and the land of the ridges will be kept dry. If there were no other manner of plowing the ridges on the ſides of hills, than there is in the plain lands, this method of having open furrows or drains on declivities would be impracticable; becauſe the plough could not turn up the furrows againſt the hill and againſt the ridge alſo, from the lower ſide of it. But the eaſy remedy againſt this inconvenience is to plow ſuch ridges in pairs, without throwing any earth into the trenches; and then the ridges will be plain at top, and the rain-water will run ſpeedily downwards to the next trench, and thence to the head land; and ſo out of the field. Theſe trenches will be made, as well as kept always open, by plowing in pairs; and this is abundantly more eaſy than the way of plowing ridges ſingly.

Every time of plowing the ridges muſt be changed as to the pairs; ſo that the furrow, which had two ridges, or lands, turned towards it one time, muſt have two turned from it the next time; and this method keeps the ſurfaces of all the ridges or lands pretty nearly even. This, however, cannot be done on a hill, whoſe declivity is ſo great, that the plow is not able to turn a furrow againſt it; but, in this caſe, perhaps, it may be ſuffi-

ſufficient to plow the ridges obliquely enough for the furrows to be turned both ways.

This plowing in an horizontal manner, on hills, is the beſt of all others; but our farmers are not to be eaſily brought into it, though they ſee thin lands of this kind ruined for want of it; their reaſons for not doing it, are, that it would prevent the ſuppoſed benefit of croſs plowing; and that they loſe more ground by having more furrows between the ridges, than when they lay their lands flat, where the lands are made much larger than the round ridges can conveniently be.

RIDERS, *in Ship-building*, ſtrong timbers fayed on the inſide of the ſhip, and reaching from the keel upwards to the beams of the orlop, or lower deck, and ſometimes higher. They are uſually fixed in the middle of the ſhip when ſhe is conſiderably weakened by age, or lying often on the ground. Sometimes it is neceſſary to fix two riders, or riding timbers, to give the ſhip a greater ſupport; and then, one is placed before the midſhip beam, and the other abaft it. They are termed riders from being placed immediately over the floor-timbers, to which they are ſtrongly bolted.

RIDGES *of a Horſe's Mouth*, are wrinkles or riſings of the fleſh, in the roof of the mouth, running acroſs from one ſide of the jaw to the other, with interjacent furrows.

RIDING, in the ſea language, the ſituation of a ſhip which lies at anchor in a road, bay, or haven.

There are various poſitions of riding, according to the circumſtances of the tide, wind, or current; as riding athwart, riding between wind and tide, &c.

Riding athwart, is when the ſhip lies nearly at right angles with the current. This is occaſioned by the great force of the wind, which acts in oppoſition to the tide, and over-balances it by as much as the ſhip is moved acroſs its ſtream.

Riding between wind and tide, is the ſituation in which a ſhip lies, when the one counter-acts the other ſo as to diminiſh its effort conſiderably, and occaſion the ſhip to lie as it were balanced between them.

Riding eaſy, is the ſtate of a ſhip which does not ſtrain hard upon her cables, by pitching deep into the water, and riſing with a ſudden jerk, ſo as to diſlodge the anchor, or break the cable.

Riding hard, the ſtate of labouring violently at anchor in a road which is expoſed to the force of the wind and the ſwell of the ſea, ſo as to endanger the cables and anchors, beſides ſtraining the hull to a great degree. A ſhip which rolls at her anchors, always rides eaſy; whereas one that pitches uſually rides very hard.

RIGADOON, a gay and brisk dance, borrowed originally from Provence in France, and performed in figure, by a man and a woman.

RIGGING, amongſt ſeamen, a term which comprehends all the ropes, either to ſecure the maſts, or manage the ſails and yards.

Rigging is uſually divided into two parts, viz. the ſtanding, and the running.

The ſtanding rigging denotes, in general, all that which is employed to faſten and ſuſtain the ſeveral maſts of a ſhip. Such are the ſhrouds, ſtays, and back-ſtays. The ſhrouds ſuſtain the maſts on each ſide, the ſtays ſupport them from before, and the back-ſtays from behind. Back-ſtays however are only uſed to the top-maſts; their intent being anſwered on the lower-maſts by the aftmoſt ſhrouds.

The running rigging implies all the ropes which are employed to dilate, contract, or change the diſpoſition of the ſails. They are called running becauſe they move through a number of blocks and pullies, artfully diſpoſed amongſt the yards and maſts. The other rigging is termed ſtanding, becauſe it is always drawn tight, and is never removed but when the ſhip is either partially, or wholly unrigged. See SHROUD, STAY, and BACK-STAY.

The principal articles of the running rigging are, the haliards, to hoiſt up the ſails; the ſheets, to extend their lower corners; the braces, to wheel them about on the maſts; and the brails, to draw them up together when they are to be reduced or furled. See BRACE, BRAIL, FURL, HALIARD, and SHEET.

A maſt is rigged thus: firſt a collar, or ring of rope, is put over it, to prevent the rigging from being cut or chafed; then the runner pendants; a pair of ſhrouds on the ſtarboard ſide; a pair on the larboard; and ſo on alternately till all the ſhrouds are fixed; after which the ſtays are placed over all. The ſhrouds firſt placed on the maſt-head are the fartheſt forward, and the laſt fartheſt aft. See PENDANT.

The rigging of a yard is alſo begun by a ſort of collar; next the horſes; the braces; and laſtly the lifts.

RIGGING-OUT, thruſting out any boom to extend the foot of a ſail, as the jib-boom, which is run out from the bowſprit; the driver-boom, which projects over the ſhip's ſide; and the ſtudding ſail booms, which are thruſt out from the ſeveral yard-arms.

RIGHT, in geometry, ſignifies the ſame with ſtraight: thus, a ſtraight line is called a right one. See LINE.

As for right angle, right aſcenſion, right cone, right deſcenſion, right ſine, right ſphere, &c. they are explained under the articles ANGLE, ASCENSION, &c.

RIGHTING *of a Ship*, amongſt ſeamen, the act of raiſing or erecting her after ſhe had inclined to one ſide, on a careen or otherwiſe.

RIGHTING *the Helm*, placing it amid-ſhips, ſo as to make the ſhip continue in the courſe to which her ſtem is directed by the former impulſe of the helm.

RIGIDITY, in philoſophy, a brittle hardneſs; or that ſpecies of hardneſs ſuppoſed to ariſe from the mutual indentation of the component particles within one another.

RIGOR, in medicine, a convulſive ſhuddering, from ſevere cold, an ague-fit, or other diſorder.

RIM *of the Top*, in the ſea-language, the outer-edge of it, through which the plates of the top-maſt ſhrouds paſs.

RIME, or RHYME. See RHYME.

RIND, the coat or skin of any fruit, &c. It is alſo uſed for the inner bark of trees, or that ſoft, whitiſh, juicy ſubſtance adhering immediately to the wood.

RING, an ornament of gold, ſilver, &c. made of a circular form, and generally worn on the finger.

RING-BORE, in farriery, a hard callous ſubſtance, growing in the paſtern of a horſe, above the coronet: it is thus called from its growing quite round like a ring.

RING-WORM, in medicine, the ſame with the ſerpigo. See the article SERPIGO.

Saturn's RING, in aſtronomy. See SATURN.

RING-BOLT, in ſhip-building, a ſtrong ring of iron with a bolt in it, which is driven into the ſides or decks of a ſhip, to which the ring is firmly confined. Theſe are principally employed to faſten or ſecure the moveables on the deck at ſea, particularly the cannon, and boats.

RING-ROPE, a ſhort rope, occaſionally faſtened to the ring-bolts, to ſecure the cable, when it is to be gradually ſlackened or veered out in tempeſtuous weather.

RING-TAIL, a ſmall flying-ſail, extended occaſionally in the after-part of ſome ſmall ſhips.

RIOT, in law, the forcibly doing of an unlawful thing, of a private nature, by three or more perſons aſſembled together, for that purpoſe.

By a late act of parliament, a riot was made felony, if the rioters did not diſperſe after reading the proclamation for that purpoſe.

RIPENERS, in medicine, a kind of topical medicines, which promote ſuppuration.

RIPPLING, amongſt ſailors, a ſhort broken interrupted current, which produces a murmuring noiſe to a conſiderable diſtance.

RITE, *Ritus*, among divines, denotes the particular manner of celebrating divine ſervice, in this or that country. See the article RITUAL.

RITORNELLO, or REPEAT, in muſic, the burden of a ſong, or the repetition of the firſt or other verſes of a ſong at the end of each ſtanza or couplet.

Cuſtom has extended the uſe of the word to all ſymphonies played before the voices begin; and which ſerve by way of prelude to what follows.

In the partitions of the ſcore of the Italian muſic, we frequently find the ritornellos ſignified by the words *ſi ſuona*,

ona, to ſhew that the organ, ſpinnet, harpſichord, or the like, are to repeat ſome bars of what the voice has been ſinging.

RITUAL, a book directing the order and manner to be obſerved in celebrating religious ceremonies, and performing divine ſervice in a particular church, dioceſe, order, or the like.

RIVER, *Fluvius*, or *Flumen*, a current, or ſtream of freſh water flowing in a bed or channel, from its ſource into the ſea.

The great, as well as the middle-ſized rivers, proceed either from a confluence of brooks and rivulets, or from lakes; but no river of conſiderable magnitude flows from one ſpring, or one lake, but is augmented by the acceſſion of others. Thus the Wolga receives above two hundred rivers and brooks before it diſcharges itſelf into the Caſpian Sea; and the Danube receives no leſs, before it enters the Euxine Sea. Some rivers are much augmented by frequent rains, or melted ſnow. In the country of Peru, and Chili, there are ſmall rivers, that only flow in the day; becauſe they are only fed by the ſnow upon the mountains of the Andes, which is then melted by the heat of the ſun. There are alſo ſeveral rivers upon both ſides the extreme parts of Africa, and in India, which for the ſame reaſon are greater by day than by night. The rivers alſo in theſe places are almoſt dried up in ſummer, but ſwell and overflow their banks in winter, or in the wet ſeaſon. Thus the Wolga in May and June is filled with water, and overflows its ſhelves and iſlands, though at other times of the year it is ſo ſhallow, as ſcarcely to afford a paſſage for loaded ſhips. The Nile, the Ganges, the Indus, &c. are ſo much ſwelled with rain or melted ſnow, that they overflow their banks; and theſe deluges happen at different times of the year, becauſe they proceed from various cauſes. Thoſe that are ſwelled with rain, are generally higheſt in winter, becauſe it is uſually then more frequent than at other times of the year; but if they proceed from ſnow, which in ſome places is melted in the ſpring, in others, in ſummer, or between both, the deluges of the rivers happen accordingly. Again, ſome rivers hide themſelves under-ground, and riſe up in other places, as if they were new rivers. Thus the Tigris meeting with mount Taurus, runs under it, and flows out at the other ſide of the mountain: alſo, after it has run through the lake Toſpia, it again emerges, and being carried about eighteen miles under ground, breaks out again, &c.

The channels of rivers, except ſuch as were formed at the creation, Varenius thinks, are artificial. His reaſons are, that, when a new ſpring breaks out, the water does not make itſelf a channel, but ſpreads over the adjacent land; ſo that men were neceſſitated to cut a channel for it, to ſecure their grounds. He adds, that a great number of channels of rivers are certainly known from hiſtory to have been dug by men.

The water of moſt rivers flow impregnated with particles of metals, minerals, &c. Thus ſome rivers bring ſands intermixed with grains of gold; as in Japan, Peru, and Mexico, Africa, Cuba, &c. particularly in Guinea is a river, where the negroes ſeparate the gold duſt from the ſand, and ſell it to the Europeans who traffic thither for that very purpoſe. The Rhine in many places is ſaid to bring a gold mud. As to rivers that bring grains of ſilver, iron, copper, lead, &c. we find no mention of them in authors; though, doubtleſs, there are many, and it may be to them that mineral waters owe many of their medicinal virtues.

Theory of the Motion of RIVERS. The running of rivers is upon the ſame principle as the deſcent of bodies on inclined planes; for water no more than a ſolid can move on an horizontal plane, the re-action of ſuch a plane being equal and contrary to gravity, entirely deſtroys it, and leaves the body at reſt: here we ſpeak of a plane of ſmall extent, and ſuch as coincides with the curved ſurface of the earth. But if we conſider a large extent or long courſe of water, then we ſhall find that ſuch water can never be at reſt, but when the bottom of a channel coincides every where with the curved ſurface of the earth.

Let A D F (plate CX. *fig.* 1.) be the curved ſurface of the earth, C its cenrre, C D, C E two right lines drawn from thence, and E G a tangent to the earth in the point D. Then it is plain if B D were a channel of water, the water could not run, or move, becauſe they are every where at an equal diſtance from the center C, and therefore equally affected by gravity. But if there be any place above the ſurface of the earth, as E, where water can be found, 'tis evident that water can deſcend in a channel to any part of the earth's ſurface between B and D, becauſe every point in the line E D is nearer to the center of the earth, and therefore below the point or place E; and its velocity will be ſo much the greater as it tends to a point nearer B, and ſloweſt of all, when it moves in the direction of the tangent E D.

Hence it appears that the ſource E of all rivers and ſtreams muſt be more than a ſemi-diameter of the earth C B diſtant from the center C. And ſince all great rivers run to the ſea or ocean where they diſembogue their waters at the point D, the line D C is a ſemidiameter, and =4000 miles nearly. Alſo the courſe of all long rivers being in the direction of the tangent at the point D, if they were repreſented by the tangent-line E G, then the height of the ſource E above the common ſurface of the earth at B would be eaſily found. Thus, ſuppoſe E D were the river Niger in Africa, whoſe ſource is more than 3000 miles from the ſea; but put E D = 3000, and ſince C D = 4000, we ſhall have C E = 5000, and C E − C B = 1000 = B E = the height of the ſource. But ſince we know of no mountains above three or four miles high, it is plain the river Niger, and all ſuch long rivers, are ſo far from moving in a tangent, that their courſe muſt be very nearly of the ſame curvature with the earth's ſurface, and inſenſibly diſtant from it.

Since bodies move on planes ever ſo little inclined, except ſo far as they are prevented by friction, and ſince the friction of the particles of water among themſelves is inconſiderable, it follows that the water ſituated on a plane ever ſo little inclined, will commence a motion: and if the plane be conſiderably inclined, and the quantity of water great, its velocity will be proportional, and its momentum ſuch as will ſoon begin to wear away the earth, and create itſelf a courſe or channel to glide in. In rivers that are made, it is uſual to allow the fall of one foot in 300.

If we allow the ſame declivity to rivers which make their own way, then we find their height at their ſource above the common ſurface of the ſea, as in example of the Niger thus: As 300 : 1 :: 5280 : $\frac{5280}{300}$ = the height at one mile, or 5280 feet. Then again ſay, as 1 : $\frac{5280}{300}$ :: 3000 : $\frac{5280 \times 3000}{300} = 5280 \times 10 = 10$ miles.

From whence it is evident, that the continents and iſlands ought to be much above the ſurface of the ſea, to give a neceſſary deſcent and courſe to the waters through them.

Let A B C D (*fig.* 2.) be the ſection of a reſervoir, and B C I K the ſection of a canal of water ſupplied from thence, and A B N the horizontal line. Now, ſince the particles of water are governed by the common laws of gravity; the velocity of a particle at any part of the bottom of the canal, as F or H, will be the ſame as it would acquire by falling through the perpendicular altitude O F or L H, that is, as $\sqrt{OF}$ to $\sqrt{LH}$. Hence the velocity of the ſtream is accelerated.

For the ſame reaſon the velocity of a particle at the bottom of the ſtream H is to the velocity of a particle at the top G, as $\sqrt{LH}$ to $\sqrt{MG}$; conſequently the ſtream moves with a greater celerity at bottom than at top.

The quantity of the water which paſſes through the ſection of the ſtream H G, is the ſame that paſſes through the ſection of the reſervoir B C in the ſame time. The ſame may be ſaid of any other ſection F E; therefore the quantity of water, paſſing by any two ſections of the ſtream F E and G H, in the ſame time, is the ſame.

Since there runs the ſame quantity of water by G H as by F E in the ſame time; and ſince the velocity at G H is greater than at F E; and, laſtly, ſince the breadth of the canal is ſuppoſed to be every-where the ſame; therefore it follows, that the depth G H muſt be leſs than

Fig. 1. Motion of Rivers.

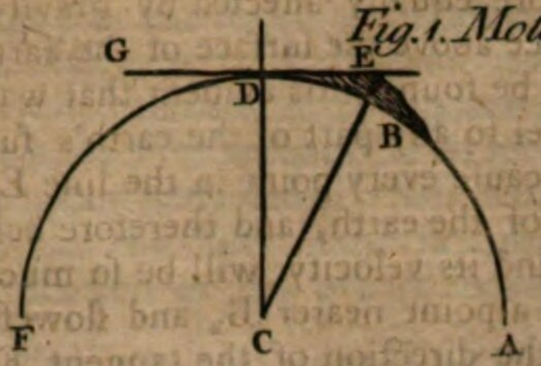


Fig. 2.

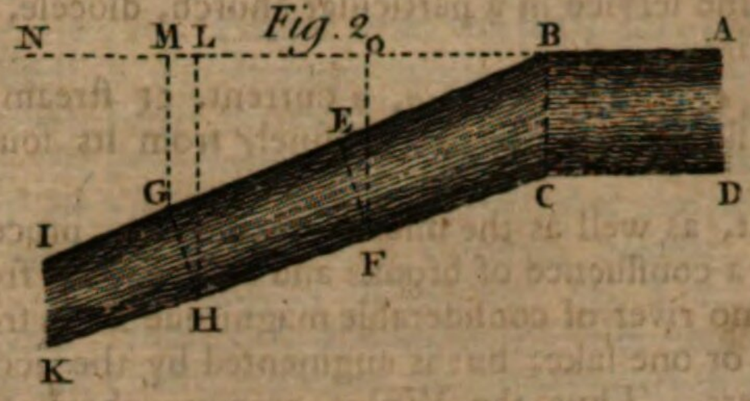


Fig. 3. Rocket.

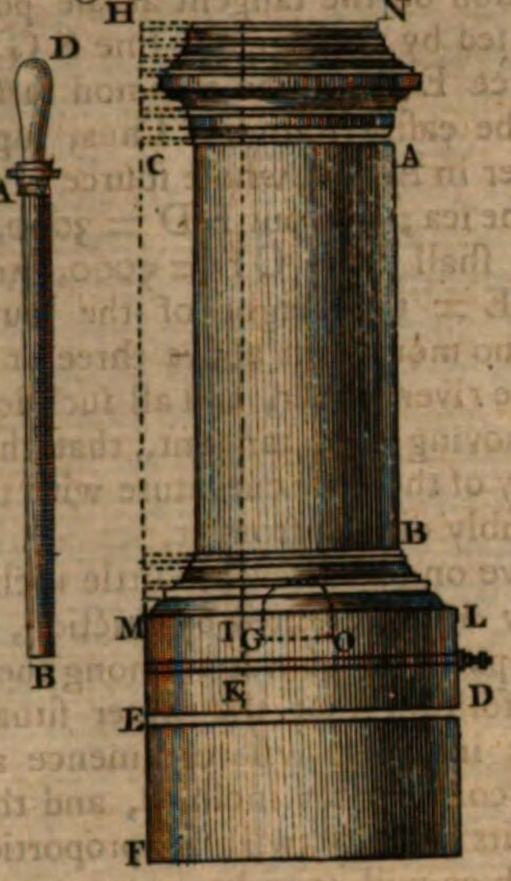


Fig. 4.

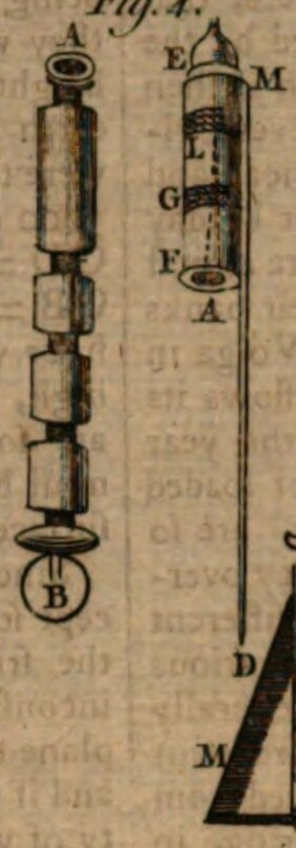


Fig. 5.

Fig. 13. Sailing.

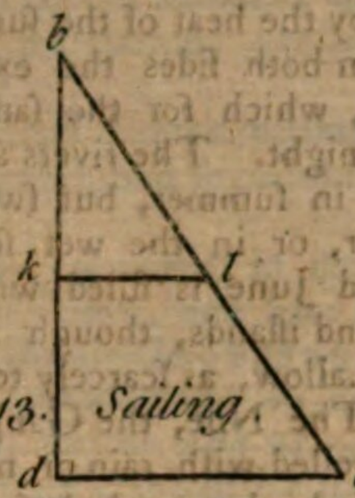
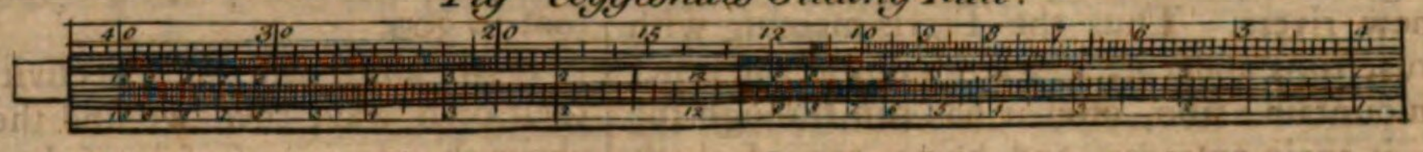


Fig Coggeshals Sliding Rule.



the depth F I, and to the depth of the stream moft conveniently decreafe as it runs.

4. The ſtream proceeds, the depth H G decreaſing, the lines M G and L H will approach nearer to an equality; and therefore the different velocities of the water at top and bottom will approach much fafter to an equality, as being proportionate to the figure of thoſe lines. This approach to an equality is much farther promoted, by the upper parts being continually accelerated by the lower, and the lower parts retarded continually by the lower motion of the waters above, and preſſing upon them.

Since the difference of the defcending velocities is greateſt near the head of the ſtream, the waters will there fall or defcend with the greateſt impetuoſity, or cauſe the loudeſt noiſe. But in the courſe of rivers, the accelerated velocity is quickly reduced to an equable or uniform velocity, by the reſiſtence it meets with from the bottom and ſides of the channel, which reſiſtence will be as the ſquares of the velocities, and therefore ſoon become ſo great as to equal the accelerating force, and be communicated to the middle part of the ſtream, cauſing the whole to move uniformly. Hence, in rivers, the inclination of the water is ſloweſt at the ſides and bottom of the channel, becauſe there the reſiſtence begins, which is afterwards communicated to all the other parts; and in different parts of the ſame river, the uniform velocity is greateſt, where the bottom of the channel has the greateſt declination, or declivity, becauſe the relative power of the moving particles is there greateſt. Again, in thoſe parts of the river where the velocity of the ſtream is leaſt, the depth of the water is greateſt, and vice verſa, becauſe equal quantities paſs through unequal ſections of the river in the ſame time. Hence alſo it follows, that the momentum of running water muſt be every where the ſame for a given quantity.

RIVULET, a diminutive of river. See RIVER.

ROACH, in ichthyology, a ſpecies of cyprinus, with the iris and belly-fins uſually red; it is generally, when full grown, nine inches long, but it ſometimes grows conſiderably larger.

ROACHING of alum, is the laſt proceſs in making alum, which being lixiviately waſhed in a ciſtern of ſtrong alum-water, is put into leaden pots, and adventitiouſly or water added every day, and often ſtirred over the fire to melt, and boil a little, or till it come to a great conſiſtence, where it is ſuffered to ſtand and cool, and is what they call roach, reaching, or rock alum. See ALUM.

ROAD, an open way or paſſage, formed for the communication between one place and another, for the paſſage of travellers, carriages, &c.

ROADING, in agriculture, the method of making roads in the moſt convenient manner, and at the leaſt expence, conſiſtent with the nature of the ſoil, and the materials to be had in the neighbourhood.

Roads are of different kinds, according to the different purpoſes for which they are made, and the different materials of which they are compoſed. Thoſe for the paſſage of carriages muſt be made as level as poſſible, and the materials of which they are compoſed muſt be ſuch as will bind together, and form a firm ſolid ſurface, which will not be eaſily waſhed away by the rains, nor ſoften by the froſts. Thoſe for the paſſage of horſes muſt be made as ſmooth as poſſible, and the materials of which they are compoſed muſt be ſuch as will not eaſily wear into holes, nor be waſhed away by the rains, nor ſoften by the froſts. Thoſe for the paſſage of foot-paſſengers muſt be made as ſmooth as poſſible, and the materials of which they are compoſed muſt be ſuch as will not eaſily wear into holes, nor be waſhed away by the rains, nor ſoften by the froſts. Thoſe for the paſſage of cattle muſt be made as ſmooth as poſſible, and the materials of which they are compoſed muſt be ſuch as will not eaſily wear into holes, nor be waſhed away by the rains, nor ſoften by the froſts.

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ROAD, an open way, or public paſſage, forming a communication between one place and another.

ROASTING, in metallurgy, the ſeparation of volatile bodies from thoſe which are more fixed, by the combined action of air, and fire; and is generally the firſt proceſs in the ſeparation of metals from their ores: it differs from ſublimation only in this, that in this operation the volatile parts are diſſipated, when reſolved into vapours; whereas in that, they are preſerved. See SUBLIMATION.

Sulphur and arſenic are in this manner collected, and preſerved, in the roaſting of many ores; and ſublimation made, as it were, occaſionally in the proceſs.

The ſeparation of the volatile parts of bodies from the more fixed is, however, in many caſes very difficult, and much nicety is required in the conducting this operation; this is the caſe, for inſtance, when the whole compound body melts in almoſt the ſame degree of fire that is neceſſary to raiſe, and diſſipate the volatile parts in the air; in ſuch caſes, care muſt be taken, firſt previouſly to pound a little the body to be roaſted, that its ſurface contiguous to the air may be increaſed in extent. A gentle fire is alſo neceſſary on ſuch occaſions, and a very free acceſs of the air, which is the vehicle of theſe vapours. When the body in the roaſting grows on theſe occaſions into large lumps or clots, the ſurface of it muſt be reſtored to the neceſſary extent, by repeated poundings; for it is neceſſary above all things, that the matter be kept extended and recent, and never collected into a heap.

Roaſting, as commonly practiſed, is ſubject to many inconveniences, which may be moſt of them eaſily remedied, and the whole buſineſs reduced to a few eaſy rules. 1. The roaſting of ores ſhould be always performed, without addition, when the ores are rich, or of itſelf merely of a metallic nature. But the additions of quicklime, pot-aſhes, iron-filings, and the like, are neceſſary, when arſenical, antimonial and ſulphureous matters are found to be mixed with the ores. 2. The fire is to be ſo regulated from the firſt, that only the lighter or more volatile ſulphureous or arſenic fumes may fly off, otherwiſe the more metallic part would likewiſe go, and without ſome contrivance to catch it would be loſt. The ore muſt, however, always feel the force of an open flame, otherwiſe the ſulphur, arſenic, &c. will never be thoroughly diſlodged. 3. The more theſe immature ſubſtances abound in ore, the gentler the fire ſhould be at firſt; and when the greater part of the ſulphureous matter is thus exhaled, the fire is then to be quickened. 4. Where ſuch additions are uſed, as are not metalline, as lime, mud, pot-aſh, &c. they ought always to be ſeparated afterwards from the matter before the fuſion, by waſhing.

ROB, in pharmacy, the juices of fruits purified and inſpiſſated till it is of the conſiſtence of honey.

ROBBERY, in law, a felonious taking away another man's goods from his perſon, preſence, or eſtate, by putting him in fear.

ROBERVALLIAN LINES, certain lines uſed for the tranſmutation of figures, and ſo called from their inventor M. de Roberval.

ROBORANTS, *roborantia*, in pharmacy, medicines which ſtrengthen the parts, and give new vigour to the conſtitution. See the article STRENGTHENERS.

ROCKET, in pyrotechny, an artificial fire-work, conſiſting of a cylindrical caſe of paper, filled with a compoſition of certain combuſtible ingredients; which, being tied to a ſtick, mounts into the air, to a conſiderable height, and there burſts.

The rocket, above defined, is properly the ſky-rocket; the method of making which, is this. 1. A concave cylindrical mould, A B, plate CX. *fig.* 3. is turned of hard-wood, with a baſe B D, and a capital H C, uſually adorned with ſuitable mouldings. This cylinder muſt be open at both ends, and its dimenſions, for rockets of various ſizes, as in the following article. When large, it is ſometimes alſo made of braſs or tin; and when ſmall, of bone. 2. Of the ſame matter with the cylinder, is prepared a quadra, or foot, M E; in the middle of which is turned a hemiſphere G O, conſiderably leſs than the cavity of the cylinder; making the cap or head of another cylinder I K, and reaching up within the caſe, where it is kept ſteady by a pin L M.

Authors do not agree about the proportions.—Simionowitz deſcribes thoſe that follow: if the diameter of the aperture H N be equal to that of a leaden ball of a pound, or at moſt two pounds weight; the height of the cylinder, with the baſe and capital H C, to be ſeven diameters, and the height of the quadra F E, 1 $\frac{1}{4}$. The altitude of the cylinder K I, 1. The diameter H N, $\frac{19}{23}$. The diameter of the hemiſphere G, $\frac{2}{3}$. The height of the capital A C, 1. The ſame author adds, that he finds by abundant experience, that if the diameter of the aperture be divided into 100 parts, according to the different weight of the leaden balls, to whoſe diameter it is equal, the following numbers, being multiplied by 7, give the height H E.

Weight of leaden ball.	Subſeptuple of altitude H E.
1	100
2	98
4	96
6	94
10	91
15	88
23	86
30	82
40	78
50	75
70	67
100	57

The mould being ready, a wooden cylinder or mould A B (*fig.* 4.) is provided, whoſe diameter is $\frac{3}{4}$ of the aperture of the frame, and its length equal to the height of the ſame; to which is fixed a haft or hilt A D. About this mould is a thick ſtrong paper rolled, till ſuch time as it fills the cavity of the frame. This done, where the haft is joined to the cylinder, as at A, it is choaked, i. e. firmly bound round with fine pack-thread, ſo as to conſtringe or ſtraighten the cavity thereof. The part thus choaked or bound up F G, to be equal to the hemiſphere G O.

The caſe is now taken off the mould, and put into the cavity of the frame, the choak G F upon the hemiſphere; and in this diſpoſition is filled with a compoſition deſcribed in the following table, rammed ſtrongly in by means of a wooden cylinder, or rammer fitting the cavity, and a mallet.

When filled, a paper-cap of a conical form is glued over the end of the caſe filled laſt; and the ſpace left atop filled with whole gunpowder, to the height of about one diameter; then the rocket bound, or choaked in E, as before in G. Laſtly, the rocket is bored, as is repreſented in A L, care being taken to do it in the middle. Some, indeed, bore the rocket, as they fill it, by thruſting a long, ſharp ſpike through the lower baſis, and drawing it out again, when the rocket is full; but it is beſt not to bore till the rocket be uſed.

The boring is to go two-thirds of the height of the rocket, abating one diameter of the cavity. The diameter of the bore in G is to be $\frac{1}{4}$ of the diameter of the cylinder; and in L $\frac{1}{8}$ of the lower diameter.

To make the rocket mount ſtraight up, it is tied faſt to the end of a long ſlender ſtick, M D, eight times as long as the rocket, in ſuch manner, as that, when poiſed on the finger near the touch-hole F, the ſtick (which is uſually made biggeſt at this end, and ſloping gently to the other) may preponderate, though very little. The rocket thus equipped, is hung at freedom, and lighted with port-fire.

Note, Some, inſtead of a ſtick to make the rocket mount, furniſh it with two wings, as M N, which have the ſame effect; and, inſtead of paper, ſome make the caſes of wood covered with leather; others of a thin iron plate. And ſome, inſtead of a wooden ſtick, uſe an iron-wire, with a plummet at the end of it.

The compoſition with which rockets are filled, conſiſts of the following ingredients, viz. ſalt-petre, charcoal, and ſulphur, all well ground; but the proportions of theſe are various, for rockets of various ſizes; as in the following table. Noting, that in ſmall rockets, gunpowder-duſt is added.

Compoſitions of ROCKETS of various ſizes.

Weight of Rocket.	Salt-petre	Sulphur	Charcoal.	Gunpowder-duſt.
lb	lb	lb	lb	
100 or 60	30	10	20	
50 30	30	7	18	
20 18	42	12	26	
15 12	23	8	16	
10 9	62	9	20	
9 6	35	5	10	
5 4	64	8	16	
3 2	60	2	15	
1		2	6	32
Ounces.	Oun	Oun	Oun.	Ounces.
9	4	1	2	9
6	12	$1\frac{1}{2}$	4	15
3	2	$\frac{1}{2}$	$1\frac{1}{2}$	12
1			2	15

Note, ſeveral rockets being diſpoſed round the circumference of a wheel, whether circular or polygonous, the head of the one is applied to the tail of another, and the wheel put in motion; as one rocket is ſpent, another will take fire; and the wheel be continued in its rotation.

As an additional ornament to rockets, it is uſual to furniſh them either with ſtars or with ſerpents, or ſparks, which take fire when the rocket burſts; and ſometimes little rockets are incloſed in great ones, to take fire when the large one is at its greateſt height.

To make Stars for ROCKETS. Mix three pounds of ſalt-petre with eleven ounces of ſulphur, three ounces of beaten gunpowder, and ten of antimony. Moiſten the maſs with gum-water, and form them into little balls of the ſize of filberds; drying them well, either in the ſun or an oven. When dry, incloſe a number of them in the conical cap of the rocket.

*Theory of the Flight of Sky-*ROCKETS. Mariotte takes the riſe of rockets to be owing to the impulſe or reſiſtence of the air againſt the flame: Dr. Deſaguliers accounts for it otherwiſe.

Conceive the rocket to have no vent at the choak, and to be ſet on fire in the conical bore; the conſequence will be, either that the rocket would burſt in the weakeſt place, or if all its parts were equally ſtrong, and able to ſuſtain the impulſe of the flame, the rocket would burn out immoveable. Now, as the force of the flame is equable, ſuppoſe its action downwards, or that upwards, ſufficient to lift forty pounds. As theſe forces are equal, but their directions contrary, they will deſtroy each other's action.

Imagine, then, the rocket opened at the choak; by this means the action of the flame downwards is taken away, and there remains a force equal to forty pounds acting upwards, to carry up the rocket and the ſtick it is tied to. Accordingly, we find that if the compoſition of the rocket be very weak, ſo as not to give an impulſe greater than the weight of the rocket and ſtick, it does not riſe at all; or if the compoſition be ſlow, ſo that a ſmall part of it only kindles at firſt, the rocket will not riſe.

The ſtick ſerves to keep it perpendicular; for if the rocket ſhould begin to ſtumble, moving round a point in the choak, as being the common center of gravity of rocket and ſtick, there would be ſo much friction againſt the air, by the ſtick between the center and the point, and the point would beat againſt the air with ſo much velocity, that the reaction of the medium would reſtore it to its perpendicularity.

When the compoſition is burnt out, and the impulſe upwards is ceaſed, the common center of gravity is brought lower towards the middle of the ſtick; by which means the velocity of the point of the ſtick is decreaſed, and that of the point of the rocket increaſed; ſo that the whole will tumble down, with the rocket-end foremoſt.

All the while the rocket burns, the common center of gravity is ſhifting and getting downwards, and ſtill the faſter and the lower, as the ſtick is the lighter; ſo that it ſometimes begins to tumble before it be burnt out; but when the ſtick is a little too heavy, the weight of the rocket bearing a leſs proportion to that of the ſtick, the common center of gravity will not get ſo low, but that the rocket will riſe ſtraight, though not ſo faſt.

*Method of making a Water-*ROCKET. Make a rocket after the uſual manner, excepting the number of choaks. Let its diameter be equal to that of a leaden-ball, of two or three inches diameter, and let it be bored to a third part of its height. Incloſe the rocket in a hollow paper cylinder, which ſmear over with melted pitch or wax, that it may reſiſt the moiſture.

Note, the weight of the rocket is to be ſo proportioned to that of the water, that the whole cylinder may be emerged. Some, inſtead of a cylinder, uſe a truncated cone, or even a ſpheroid; and ſome hang a weight to the end at which it is lighted.

ROD, a wand, or long ſlender ſtaff.

ROD is alſo uſed for a land meaſure of ſixteen feet and a half: the ſame with perch and pole.

ROD, in gauging. See GAUGING.

*Black-*ROD, a ſtaff carried by the king's gentleman-uſher, as a badge of his office; this rod or ſtaff is black, and has a lion in gold on its top.

ROE, the ſpawn or ſeed of fiſh. That of the male-fiſhes is uſually diſtinguiſhed by the name of ſoft roe, or milt, and that of the female, by hard roe, or ſpawn.

ROGATION, in the Roman juriſprudence, a demand made by the conſuls or tribunes of the Roman people, when a law was propoſed to be paſſed. Rogatio is

alſo

alſo uſed for the decree itſelf made in conſequence of the people's giving their aſſent to this demand, to diſtinguiſh it from a *ſenatus conſultum*, or decree of the ſenate.

ROGATION-WEEK, the week immediately preceding Whitſunday, ſo called from the three faſts therein on Monday, Tueſday, and Wedneſday, which are alſo called rogations, or rogation-days, from the extraordinary prayers and ſupplications at this time offered to God by devout Chriſtians, to appeaſe his anger and deprecate his judgments.

ROGUE, in law, an idle ſturdy beggar; who by ancient ſtatutes is for the firſt offence called a rogue of the firſt degree, and puniſhed by whipping, and boring through the griſtle of the right ear with a hot iron; and for the ſecond offence, is termed a rogue of the ſecond degree, and if above eighteen years of age, ordered to be executed as a felon.

ROGUES-YARN, in ſea-affairs, a yarn or thread in all cordage made for the king's ſervice, by which ſuch cordage may be eaſily diſtinguiſhed from any other, as the rogues-yarn is twiſted contrary to all the other. The uſe of this precaution is to prevent or diſcover embezzlement of the cables, hawſers, &c. by the boatſwain, who is charged with them.

ROLL, in manufactories, ſomething wound and folded up in a cylindrical form.

ROLL, in law, ſignifies a ſchedule or parchment which may be rolled up by the hand into the form of a pipe.

Muſter-ROLL, that in which are entered the ſoldiers of every troop, company, regiment, &c.

Rider-ROLL, a ſchedule of parchment frequently ſewed or added to ſome part of a roll or record.

ROLLS *of Parliament*, are the manuſcript regiſters, or rolls of the proceedings of our ancient parliaments, which before the invention of printing were all engroſſed on parchment, and proclaimed openly in every county.

ROLL, or ROLLER, is alſo a piece of wood, iron, braſs, &c. of a cylindrical form, uſed in the conſtruction of ſeveral machines, and in ſeveral works and manufactures.

ROLLER, in ſurgery, a long and broad bandage, uſually of linen cloth, rolled round any part of the body, to keep it in, or diſpoſe it to a ſtate of health.

ROLLING-PRESS *Printing*. See the article PRINTING.

ROLLING, in naval affairs, the motion of a ſhip rocking from one ſide to the other, as produced by the agitation of the waves.

When a ſhip rolls heavily at ſea, it expoſes the maſt continually to the danger of being carried away. It is generally occaſioned by the ſhip having too great a quantity of heavy ballaſt near the keel, which makes the veſſel very ſtiff. See the article TRIM.

The rolling motion of a ſhip appears to begin from a center at the keel, where the garboard ſtrake or plank is let in; if ſo, there is a motion below it to the depth of the keel, as well as the motion aloft; although the keel has but little motion comparatively with the motion above: and the greater will that motion be in proportion to its diſtance, even to the ſpindle at the top-maſt-head, which makes the radius, and conſequently the circle greater. The keel being intire, as the body of the veſſel moves one way, the lower part of the keel moves contrariwiſe; and the deeper it is, the larger is the body or circle of water moved thereby. Is it not therefore demonſtrable, that the greater the body of water is, which oppoſes the motion of the keel, the greater is the oppoſition? For if the keel had no motion from the center before-mentioned, or from the ſtep of the main-maſt, which perhaps is more properly the center of motion, there would be no motion above it.

ROLLING-TACKLE, a tackle hooked to the weather-yard-arm, to confine the yard to leeward, and prevent it from rubbing the maſt, and galling it by the agitation of the ſhip.

ROMAN, in general, ſomething belonging to the city of Rome.

King of the ROMANS, in modern hiſtory, is a prince elected to be ſucceſſor to the reigning emperor of Germany.

ROMAN *Order*, in architecture, the ſame with the Compoſite order. See the articles ORDER and COMPOSITE.

ROMANCE, in matters of literature, a fabulous relation of certain adventures, deſigned for the entertainment and inſtruction of the readers.

ROMPEE, or ROMPU, in heraldry, is applied to ordinaries that are repreſented as broken, and to chevrons, bends, or the like, whoſe upper points are cut off.

ROOD, a quantity of land equal to forty ſquare perches, or the fourth part of an acre.

ROOF, in architecture, the uppermoſt part of a building.

The roof contains the timber-work, and its covering of ſlate, tile, lead, &c. though carpenters uſually reſtrain the word to the timber-work only.

The form of roofs is various; ſometimes it is pointed, in which caſe the moſt beautiful proportion is to have its profile an equilateral triangle: ſometimes it is ſquare, that is, the pitch or angle of the ridge is a right angle, which therefore is a mean proportion between the pointed and flat roof, which laſt is in the ſame proportion as a triangular pediment: this is chiefly uſed in Italy, and the hot countries, where there is but little ſnow. Sometimes roofs are made in the pinnacle form: ſometimes they have a double ridge; and ſometimes they are mutilated, that is, conſiſt of a true and a falſe roof, which is laid over the former: ſometimes again they are in the form of a platform, as moſt of the eaſtern buildings are; and ſometimes they are truncated, that is, inſtead of terminating in a ridge, the roof is cut ſquare off at a certain height, covered with a terraſs, and incompaſſed with a balluſtrade; and ſometimes, again, a roof is made in the manner of a dome. When the walls have been raiſed to their deſigned height, the vaults made, the joiſts laid, the ſtairs, &c. brought up, then the roof is to be raiſed, which embracing every part of the building, and with its weight equally preſſing upon the walls, is a band to all the work; and beſides, defends the inhabitants from rain or ſnow, the burning heat of the ſun, and the moiſture of the night, and is of no ſmall advantage to the building, in caſting off the rain water from the walls.

ROOK, in ornithology, a ſpecies of the wholly black corvus. See CORVUS.

ROOT, *Radix*, among botaniſts, denotes that part of a plant which imbibes the nutritious juices of the earth, and tranſmits them to the other parts.

The roots of plants are diſtinguiſhed, according to their different forms, into bulboſe, fibroſe, granuloſe, grumoſe, tuberoſe, and tap roots.

As to the gathering and preſerving roots for medicinal uſes, the Edinburgh Diſpenſatory directs that the annual roots be taken up before they ſhoot out ſtems or flowers; the biennial ones, for the moſt part, in the autumn of the firſt year; and the perennial ones when the leaves begin to fall, and therefore generally in autumn: then being cleanſed by waſhing, and freed from the withered and decayed fibres, they are to be hung in a ſhady place pervious to the air, till they are moderately dry: the thicker roots ſhould be ſlit lengthwiſe; or they may be cut tranſverſely into thin pieces, and the pith taken out.

ROOT-GRAFTING, in gardening. See the article GRAFTING.

ROOT, in mathematics, implies a quantity conſidered as the baſis or foundation of a higher power; or one which being multiplied into itſelf any number of times, produces a ſquare, cubic, biquadratic, &c. quantity; called the ſecond, third, fourth, &c. power of the root, or quantity, ſo multiplied into itſelf. Thus a is the ſquare root of $a \times a$, or a^2; and 4 the ſquare root of $4 \times 4 = 16$. Again, a is the cube-root of $a \times a \times a = a^3$; and 3 the cube-root of $3 \times 3 \times 3 = 27$: and ſo on. See EXTRACTION.

ROOTS, *Radices*, in grammar, are the primitive words of a language, whence the others are formed or derived.

ROPE, hemp, hair, &c. ſpun out into a thick yarn, and then ſeveral ſtrings of this yarn twiſted together by means of a wheel. When made very ſmall, it is called a cord, and when very thick, a cable.

ROPE, a general name given to all the different kinds of rope in a ſhip. See RIGGING, CABLE, HAUSER, TOW LINE, WARP, &c.

ROPE-BANDS, a ſmall cord, in length about three or four times the circumference of the yard. They are inſerted through eye-lid holes for the whole length of the upper-edge of the ſquare ſails, and are uſed to faſten the head of the ſail to the yard.

ROPE YARN, a thread or twiſted line of hemp, which is the firſt and ſimpleſt part of a rope. A number of theſe are twiſted together to form a ſtrand, in proportion to the ſize of the rope, whereof the ſtrand makes a part. Three ſtrands are then twiſted into one another, which completes the proceſs of ordinary rope-making. But cables, hauſers, and other ground-tackling, are compoſed of three ſtrands, each of which is formed by three leſſer ones.

ROSACEOUS, among botaniſts, an appellation given to ſuch flowers, as are compoſed of ſeveral petals or leaves, diſpoſed in a ſort of circular form, like thoſe of the roſe: ſuch are the flowers of the piony, crowfoot, cinquefoil, &c. In this ſort of flowers the diſpoſition only of the leaves is regarded, their number being of no conſequence. It is very ſeldom that the number is two or four, except in the circæa and onagra. The moſt frequent number of leaves in theſe flowers is five, and ſuch as have four differ from the cruciform flowers, not only in their diſpoſition, but in this, that the number is in the ſame ſpecies indeterminately, four, five, or ſix, as is the caſe in the clematitis, the capers, and the ſpecies of rue, whereas in the cruciform ones it is ever conſtant. See BOTANY.

ROSARY, among the Roman-Catholics, the ſame with chaplet.

ROSE, *Roſa*, in botany, a genus of plants, the flower of which is compoſed of five petals, obverſely cordated, and arranged in a circular form: the fruit is formed of the fleſhy baſe of the cup, which is of a turbinated figure, coloured, ſoft, containing only one cell drawn together at the neck, and coronated with ſome irregular laciniæ; the ſeeds are numerous, oblong, and hairy.

The wild briar, with beautiful pinnated leaves, a white or pale red flower, and the common hip for its fruit, is that above deſcribed: and, indeed, all the beautiful roſes in our gardens, are only varieties of this ſpecies, principally owing to culture; the red, the damaſk, the white, the variegated, &c. roſes, being all produced from this original ſpecies.

The flowers of the red roſe are aſtringent, thoſe of the damaſk-roſe purgative, and the fruit of the wild-roſe pectoral. The roſe-water of the ſhops, diſtilled from the flowers of the damaſk-roſe, has been celebrated for many virtues; but its fragrant ſmell is the only quality now regarded in it. There is alſo a ſyrup, made either from the juice, or infuſion of the freſh flowers of damaſk-roſes.

ROSE, in architecture, an ornament cut in the form of a roſe, chiefly uſed in corniches, friezes, vaults of churches, &c. and particularly in the middle of each face in the Corinthian abacus.

ROSE-NOBLE, an ancient Engliſh gold-coin, firſt ſtruck in the reign of Edward III. It was formerly current at 6s. 8d. and ſo called becauſe ſtamped with a roſe.

ROSE-WOOD, *Rhodium*, in the materia medica. See RHODIUM.

ROSEMARY, in botany, a large ſhrubby plant, clothed with long narrow ſtiff leaves, ſet in pairs, of a dark green colour above, and hoary underneath; producing pale bluiſh labiated flowers, which ſtand in cluſters round the ſtalk in the boſoms of the leaves. It is a native of the ſouthern parts of Europe, common in our gardens, and ſeems to grow larger and more woody in this than in moſt other countries. It flowers in April and May, and ſometimes again about the end of Auguſt.

Roſemary is a warm pungent aromatic; particularly uſeful in phlegmatic habits, and debilities of the nervous ſyſtem; of the ſame general nature with lavender, but with more of a camphorated kind of pungency, and of a ſtronger, and to moſt people leſs grateful, ſmell. The tender tops are the ſtrongeſt both in ſmell and taſte, and next to theſe the cups of the flowers; which laſt, though ſomewhat weaker than the leaves or tops, are nevertheleſs the moſt pleaſant, and hence are generally preferred: it is chiefly, if not wholly, in the cup, that the active matter of the flower reſides; for the bluiſh petalum, carefully ſeparated, has very little ſmell or taſte. The fragrance of theſe flowers is greatly diminiſhed, or in great meaſure deſtroyed, by bruiſing or beating; and hence the officinal conſerve, made by beating them with thrice their weight of ſugar, has very little of the flavour of the roſemary.

The leaves and tops of roſemary give out their virtues completely to rectified ſpirit, but only partially to water: the ſpirituous tinctures are of a yellowiſh green colour, the aqueous of a dark greeniſh brown. Diſtilled with water, they yield a thin, light, pale-coloured eſſential oil, inclining a little to a yellowiſh or greeniſh, of great fragrancy, though not quite ſo agreeable as the roſemary itſelf: from one hundred pounds of the herb in flower were obtained eight ounces of oil: the decoction, thus diveſted of the aromatic part of the plant, yields on being inſpiſſated an unpleaſant weakly bitteriſh extract. Rectified ſpirit likewiſe, diſtilled from roſemary leaves, becomes conſiderably impregnated with their fragrance, leaving however in the extract the greateſt ſhare both of their flavour and pungency. The active matter of the flowers is ſomewhat more volatile than that of the leaves, greateſt part of it ariſing with ſpirit. The Hungary water, uſed as a perfume, and ſometimes medicinally in nervous complaints, and which is ſaid to have received its name from its being firſt made public by an empreſs of that nation, who was cured by its continued uſe of a paralytic diſorder, is a ſtrong ſpirit diſtilled from freſh roſemary flowers: the college of Edinburgh directs a gallon of rectified ſpirit to be drawn over in the heat of a water-bath from two pounds of the flowers as ſoon as gathered: that of London takes the tops, and a ſpirit not quite ſo ſtrong; putting a gallon of proof-ſpirit to a pound and a half of the freſh tops, and drawing off in the heat of a water-bath five pints. The Hungary water brought from France is more fragrant than ſuch as is generally prepared among us.

ROS-SOLIS, SUN-DEW, an agreeable ſpirituous liquor, compoſed of burnt brandy, ſugar, cinnamon, and milk-water; and ſometimes perfumed with a little muſk: it is ſo called, as being at firſt prepared wholly of the juice of the plant ros-ſolis, or droſera.

ROSTRA, in antiquity, a part of the Roman forum, wherein orations, pleadings, funeral harangues, &c. were delivered.

ROSTRUM, in chemiſtry, implies the noſe or beak of the common alembic, which conveys the liquor diſtilled into its receiver.

ROSYCRUCIANS, ROSICRUCIANS, or *Brothers of the Roſy Croſs*, a name aſſumed by a ſect or cabal of hermetical philoſophers, who appeared, or at leaſt were firſt taken notice of, in Germany, in the beginning of the ſixteenth century. They pretended to be maſters of all ſciences, and to have many important ſecrets, particularly that of the philoſopher's ſtone.

ROT, a diſeaſe incident to ſheep, ariſing from wet ſeaſons, and too moiſt paſture.

It is a very hard thing to prevent the rot, if the year prove very wet, eſpecially in May and June. Salt-marſhes, and lands where broom grows, are the beſt places of preſervation for them. Sheep are ſometimes all cleared of the rot, when not too far gone with it, only by removing them into broom-fields. Scurvy-graſs, muſtard, parſley, and thyme, are alſo good for the prevention of it.

Some propoſe the giving ſheep half a handful of bay-ſalt every month or oftener; and there is great probability that this may be of ſervice: but the rational way of attacking all diſorders in cattle, is by conſidering what are the cauſes of them. It will appear upon enquiry, that wet ſeaſons are the general occaſions of the rot in ſheep, and therefore it would be adviſable for the owners, when ſuch ſeaſons come on, to remove thoſe animals into the drieſt paſtures they can, and then to feed them principally with dry ſweet hay, oats, bran, and the like; this

would prevent the occaſion: and if they were already a little infected, ſome ſalt given with their dry food, would be a happy means of curing them.

ROTA, WHEEL, in mechanics. See the article WHEEL.

ROTATION, in geometry, a term chiefly applied to the circumvolution of any ſurface round a fixed and immoveable line, which is called the axis of its rotation: and by ſuch rotations it is, that ſolids are conceived to be generated.

ROTATORES, in anatomy, the name by which ſome call the oblique muſcles of the eye.

ROTATORES is alſo applied to the trochanters of the thigh bone.

ROTONDO, or ROTUNDO, in architecture, an appellation given to any building that is round both within and without-ſide, whether it be a church, a ſalon, or the like. The moſt celebrated rotondo of the ancients, is the Pantheon at Rome.

ROTULA, in anatomy, the ſame with the patella. See PATELLA.

ROTUNDUS, in anatomy, a name given to ſeveral muſcles, otherwiſe called teres.

ROUCOU, the ſame with annotto. See the article ANNOTTO.

ROUGH-TREE, in naval affairs, a maſt or yard which is unfiniſhed, and is laid by the ſhip's ſide to ſerve as a rail, till a convenient opportunity offers to prepare it for ſervice.

ROUNDELAY, a kind of ancient poem, thus termed, according to Menage, from its form, becauſe it turns back again to the firſt verſe, and thus goes round.

ROUND-HOUSE, in naval architecture, a ſort of cabin raiſed on the after-part of a ſhip's quarter-deck in the merchant-ſervice. It is uſually the apartment of the captain, but occaſionally of other officers, or paſſengers.

ROUNDING, in ſea-affairs, certain pieces of old rope firmly wound about that part of the cable which is liable to be chaſed or fretted againſt the ſtem, bows, or cut-water. The rounding is drawn very tight about the cable, and beat on with a mallet.

ROUNDING *up a Tackle*, the act of drawing the block or pullies together when no weight is ſuſpended by it.

ROUNDO, ROUNDELAY, in muſic, a kind of burden or ritornello, where the beginning of each couplet is repeated at the end thereof.

ROUT, a public road, highway, or courſe, eſpecially that which military forces take. This word is alſo uſed for the defeat and flight of an army.

ROWER, in naval affairs, a perſon who manages the oars in a ſmall ſhip, boat, or galley; and hence

ROWING is the art of managing the oars ſo as to move a veſſel through the water. In this ſituation the oars act upon the veſſel like a lever, whoſe fulcrum is the upper-part of the veſſel's ſide; and

ROW-LOCK is the notch or opening in the ſide of the boat or galley, where the oar reſts. In boats it is commonly limited by two pins, which are called thowles.

ROW-PORTS, little holes in the ſides of a ſhip of war, wherein to thruſt the oars when it is neceſſary to row.

ROWEL, among farriers, a kind of iſſue, made by drawing a ſkain of ſilk, thread, hair, or the like, through the nape of the neck, or other part, of a horſe; anſwering to what, in ſurgery, is called a ſeton. See SETON.

The rowelling of horſes is a method of cure frequently had recourſe to, in caſes of inward ſtrains, eſpecially about the ſhoulders or hips, as alſo for hard ſwellings not eaſy to be diſſolved. The operation is this: a little ſlit being made through the ſkin, about an handbreadth below the part aggrieved, big enough to put a ſwan's quill in; the ſkin is raiſed from the fleſh, the end of the quill put in, and the ſkin blowed from the fleſh upwards, and all over the ſhoulder; then the hole being ſtopped with the finger, the part blown is beat with an hazel-ſtick, and the wind ſpread with the hand all over, and then let go; this done, a ſkain of horſe-hair, or red ſarſenet, half the thickneſs of the little finger, is put in a rowelling needle ſeven or eight inches long, and the needle is put into the hole, and drawn through again, ſix or ſeven inches higher; then the needle is drawn out, and the two ends of the rowel tied together, anointing it every day, as well as before the putting it in, with ſweet butter and hog's greaſe, and drawing it backwards and forwards in the ſkin, to make the putrid matter diſcharge itſelf more plentifully.

Others, diſliking theſe rowels, as making too large a ſore and ſcar, uſe the French rowel, which is a round piece of ſtiff leather, with a hole in the midſt, laying it flat between the fleſh and ſkin, the hole in the rowel juſt againſt that in the ſkin, ſewing it with a needle and thread drawn through the hole and the ſkin, cleaning it once in two or three days, and then anointing it afreſh.

ROYALTIES, the rights of the king, otherwiſe called the king's prerogative, and the regalia.

RUBIA, madder, in botany, &c. See the article MADDER.

RUBIGO, a diſeaſe incident to corn, commonly called mildew, being a ſpecies of blight. See the article BLIGHT.

RUBRIC, *Rubrica*, in the canon law, ſignifies a title or article in certain ancient law-books; thus called becauſe written, as the titles of the chapters in our ancient Bibles are, in red letters.

RUBRICS alſo denote the rules and directions given at the beginning, and in the courſe of, the Liturgy, for the order and manner in which the ſeveral parts of the office are to be performed. There are general rubrics and ſpecial rubrics, a rubric for the communion, &c. In the Romiſh Miſſal and Breviary are rubrics for matins, for lauds, for tranſlations, beatifications, commemorations, &c.

RUBUS, the bramble, in botany, a genus of plants. See RASPBERRY.

RUBY, *rubinus*, in natural hiſtory, a ſpecies of the chroſtaſima claſs of gems, being a beautiful gem of a red colour with an admixture of purple. See the article GEM.

This, in its moſt perfect and beſt coloured ſtate, is a gem of prodigious beauty and extreme value; it is often found perfectly pure and free from blemiſhes or foulneſs, but much more frequently debaſed greatly in its value by them, eſpecially in the larger ſpecimens. It is of very great hardneſs, equal to that of the ſapphire, and ſecond only to the diamond. It is various in ſize, but leſs ſubject to variations in its ſhape than moſt of the other gems. It is uſually found very ſmall, its moſt common ſize being equal to that of the head of the largeſt ſort of pins; but it is found of four, eight, or ten carats; and ſometimes, though very rare, up to twenty, thirty, or forty. It is never found of an angular or cryſtalliform ſhape, but always of a pebble-like figure, often roundiſh, ſometimes oblong and much larger at one end than at the other, and in ſome ſort reſembling a pear, and is uſually flatted on one ſide. It commonly is naturally ſo bright and pure on the ſurface, as to need no poliſhing; and when its figure will admit of being ſet without cutting, it is often worn in its rough ſtate, and with no other than its native poliſh. Our jewellers are very nice, tho' not perfectly determinate, in their diſtinctions of this gem, knowing it, in its different degrees of colour, under three different names: the firſt is ſimply the ruby, the name given it in its deepeſt-coloured and moſt perfect ſtate: the ſecond is the ſpinel ruby; under this name they comprehend thoſe rubies which are of a ſomewhat leſs bright colour than the ruby ſimply ſo called: the third is the balaſs-ruby; under this name they expreſs a pale yet a very bright ruby, with a leſs admixture of the purple tinge than in the deeper-coloured one; this is of leſs value than the deeper one.

We have the true ruby only from the Eaſt Indies; and the principal mines of it are in the kingdom of Pegu and the iſland of Ceylon. We have in Europe cryſtals tinged to the colour of the ruby, but they have nothing of its luſtre or hardneſs. The ruby ſeems to owe its colour to gold, it being poſſible to ſeparate a ſmall portion of gold from the little native rubies, and alſo to give the true colour of the ruby to fictitious paſte by means of that metal.

The way of preparing a metalline colour from gold and tin, for tinging glaſs of a ruby colour, is, according to Shaw, as follows: Diſſolve gold in aqua-regia, and dilute

dilute the fine yellow ſolution with a large proportion of fair water; to the mixture add a ſufficient quantity of a ſaturated ſolution of tin, made alſo in aqua-regia, at ſeveral times, and a moſt beautiful red or purple-coloured powder will ſoon fall to the bottom of the containing glaſs; decant the liquor and dry the powder, a few grains whereof being melted along with white cryſtalline glaſs, will tinge it throughout of an extremely fine purple or ruby colour.

RUBY, in heraldry, denotes the red colour wherewith the arms of noblemen are blazoned; being the ſame which in the arms of others, not noble, is called gules.

RUCTATION, BELCHING, a ventoſity ariſing from indigeſtion, and diſcharging itſelf at the mouth with a very diſagreeable noiſe. There are belches owing to repletion, and others to inanition, or emptineſs. Quincy ſays hypochondriac and hyſteric perſons are particularly liable to this diſorder. They are rather to be cured with proper ſtomachics than carminatives and hot liquors.

RUDDER, in naval architecture, a piece of timber, or ſeveral pieces faſtened together and fitted to the ſhip's ſtern-poſts, to which it is hung by irons, whereon it moves, and thereby the ſhip is ſteered. *Murray's Ship-building.*

RUDBECKIA, DWARF SUN-FLOWER, in botany, a genus of plants, the compound flower of which is radiated; but the hermaphrodite corollulæ of the diſc are tubuloſe and very numerous: the ſtamina are five very ſhort capillary filaments; and there is a ſmall orbiculated ſeed after each of the hermaphrodite corollulæ, and are all contained in the cup, affixed to a paleaceous receptacle.

RUDENTURE, in architecture, the figure of a rope or ſtaff, ſometimes plain, ſometimes carved, with which the third part of the flutings of columns are frequently filled up.

RUDERATION, in building, a term uſed by Vitruvius for the laying of pavement with pebbles.

To perform the ruderation it is neceſſary that the ground be well beated, to make it firm, and to prevent it from cracking; then a ſtratum of little ſtones are laid, to be afterwards bound together with mortar made of lime and ſand. If the ſand be new, its proportion may be to the lime as three to one; if dug out of old pavement or walls, as five to two.

RUDIMENTS, *Rudimenta*, the firſt principles or grounds of any art or ſcience, called alſo the elements thereof. See the article ELEMENT.

RUFTER HOOD, among falconers, a plain leathern hood, large and open behind, to be worn by an hawk when ſhe is firſt drawn.

RULE, *Regula*, in matters of literature, a maxim, canon, or precept, to be obſerved in any art or ſcience.

RULE, in arithmetic, denotes an operation performed with figures, in order to diſcover ſums or numbers unknown.

The fundamental rules are addition, ſubtraction, multiplication, and diviſion. See ADDITION, &c.

But, beſides theſe, there are other rules denominated from their uſe; as the rule of alligation, fellowſhip, intereſt, practice, reduction, &c.

RULE *of Three*, or *Rule of Proportion*, commonly called the *Golden Rule*, a rule which teaches how to find a fourth proportional to three given numbers.

This rule is either direct, or reciprocal, called inverſe. And thoſe are both ſimple and compound.

RULE *of Three Direct*, or *direct Proportion*, is when, of four numbers, the firſt beareth the ſame ratio or proportion to the ſecond as the third doth to the fourth.

As in theſe, 2 : 8 :: 6 : 24.

Conſequently, the greater the ſecond term is, in reſpect to the firſt, the greater will the fourth term be, in reſpect to the third.

That is, as 8, the ſecond term, is four times greater than 2, the firſt term; ſo is 24, the fourth term, four times greater than 6, the third term.

Whence it follows, that, if four numbers are in direct proportion, the product of the two extremes will always be equal to the product of the two means, as well in diſjunct, as continued proportion.

For as 2 : 2×4 :: 6 : 6×4. Or as 3 : 3×5 :: 6 : 6×5,
or 3×6×5 = 3×5×6.

But 2×6×4 = 2×4×6.

That is, the product of the extremes is equal to that of the means.

Again, the leſs the ſecond term is, in reſpect to the firſt, the leſs will the fourth term be, in reſpect to the third.

As in theſe, 2 : 8 :: 6 : 24. Here 8×6 = 48 = 24×2.

But, if 24×2 = 48, then will 48÷2 = 24, or 48÷24 = 2.

Note, any four numbers in direct proportion may be varied ſeveral ways. As in theſe,

Viz. if 2 : 8 :: 6 : 24, then 2 : 6 :: 8 : 24,
and 6 : 24 :: 2 : 8, or 24 : 6 :: 8 : 2, &c.

Theſe variations, being well underſtood, will be of no ſmall uſe in the true ſtating of any queſtion in the Rule of Three.

All queſtions in direct proportion may be anſwered by three ſeveral theorems.

Theorem 1. Multiply the ſecond and third terms together, and divide your product by the firſt term; the quotient will be the anſwer required.

	yds.	ſhill.	yds.	ſhill.	
Thus	3 :	9 ::	6 :	18	the anſwer.
		6			
		3)54(	18 ſhillings.	{ Becauſe the ſecond term was ſhillings.	

Theorem 2. Divide the ſecond term by the firſt, and multiply the quotient into the third term, and the product will be the anſwer required.

yds.	ſhill.	yds.	ſhill.
3 :	9 ::	6 :	18

Thus 3) 9 (= 3, then 3×6 = 18, as before.

Theorem 3. Divide the third term by the firſt, then multiply that quotient into the ſecond term, and the product will be the anſwer.

yds.	ſhill.	yds.	ſhill.
3 :	9 ::	6 :	18

Thus 3) 6 (= 2, and 9 × 2 = 18, as before.

Here we ſee, that all the three theorems are equally true; but the firſt is moſt general, and uſually practiſed: yet the two laſt may be readily performed, when either the ſecond or third term can be divided by the firſt, and will be found of ſingular uſe in the rules of fellowſhip, &c.

Queſtion 2. If 8 ℔. of tobacco coſt 14s. what will 56 ℔. coſt at the ſame rate?

Thus 8 ℔. : 14s. :: 56 ℔. : 4 l. 18 s. the anſwer.

14

224
56

8)784(= 98 s. = 4 l. 18 s.

Or thus 8) 56 (= 7, then 14 × 7 = 98 s. as before.

Queſtion 3. If 14 ſhillings will buy 8 ℔ of tobacco, how much will 4 l. 18 s. buy after the ſame rate?

[Stated thus, 14 s : 8 ℔ : : 4 l. 18 s. —

Then 56 × 14 = 784, and 14)784(56 ℔. the anſwer.

Queſtion 4. If 56 ℔ of tobacco be worth 4 l. 18 s. how much may I buy for 14 s. at the ſame rate?

Stated thus, 4 l. 18 s. = 98 s. : 56 ℔ :: 14 s. : ——

Then 56×14 = 784, and 98)784(8 ℔. the anſwer.

Queſtion 5. Suppoſe 4 l. 18 s. will buy 56 ℔. of tobacco, what will 8 ℔. of the ſame tobacco coſt?

This queſtion is thus ſtated, 56 ℔. : 4 l. 18 s. = 98 s. : : 8 ℔. —

Then 98×8 = 784, and 56)784(= 14s. the anſwer.

Note, the three laſt queſtions are only the ſecond varied, being propoſed purely to give an inſtance how any queſtion in this Rule of Three may be varied.

RULE *of Three Inverſe*, or *reciprocal Proportion*, is, when, of four numbers, the third, (viz. that which moves the queſtion) beareth the ſame ratio to the firſt, as the ſecond does to the fourth.

Therefore, the leſs the third term is, in reſpect to the firſt, the greater will the fourth term be in reſpect to the ſecond.

Example 1. If 16 men can do a piece of work in 6 days, how many days muſt 8 men require to do the ſame work, at the ſame rate of working?

Here it is plain, that 8 men muſt needs have more time than 16 men, to do the ſame work. Conſequently, the greater the third term is, in reſpect to the firſt; the leſs will the fourth term be, in reſpect to the ſecond.

Example 2. If 8 men can do a piece of work in 8 days, how many days will 16 men require to do the ſame work? Here it is plain, the fourth term muſt be leſs than the ſecond, becauſe 16 men undoubtedly can do the ſame work in leſs time than 8 men can.

For when, according to the true meaning or deſign of any queſtion in proportion, more requires more, or leſs requires leſs, the terms are in direct proportion.

But if more require leſs, or leſs requires more, as above, then the terms will be in reciprocal proportion.

The manner of placing down the propoſed terms is the ſame in both rules, viz. The firſt term in the ſuppoſition muſt be of the ſame kind and denomination with the third term, which moves the queſtion; and the term ſought muſt be of the ſame kind and denomination with the ſecond term in the ſuppoſition; as in the two laſt examples.

		Men.	Days.	Men.	Days.
Thus in	Example 1.	16 :	6 : :	8 :	
	Example 2.	8 :	12 : :	16 :	

The queſtion being truly ſtated, obſerve this theorem.

Theorem. Multiply the firſt and ſecond terms together, and divide their product by the third term; the quotient will be the anſwer required.

Thus in the ſecond example, $12 \times 8 = 96$.

Then 16) 96 (= 6 days, the anſwer required.

That is, 16 men may do the ſame work in 6 days, as 8 men can do in 12 days.

The reaſon of this operation, and, conſequently, of the theorem, is grounded upon this conſideration, viz. if 8 men require 12 days to do the work, it is plain one man would require 8 times 12 days, =96 days, to do the ſame work; but if one man can do it in 96 days, moſt certain 16 men can do it in one 16th part of that time. Therefore 96, divided by 16, will give the anſwer required, viz. 16) 96 (6, as before, &c.

DOUBLE RULE *of Three*, or *Compound Proportion*.

All queſtions in this rule, where five numbers are propoſed to find a fixth, may more eaſily and readily be anſwered by one general theorem, which compriſeth both the direct and inverſe rules.

But, firſt, you muſt carefully note, that, in all queſtions of this nature, three of the five propoſed terms are always conditional and ſuppoſed; and that the other two move the queſtion, as for inſtance.

Example 1. If 100 l. will gain 6 l. in 12 months, what will 300 l. gain in 9 months? Solution. Firſt ſay, if 100 l. gain 6 l. what will 300 l. gain? The anſwer will be 18 l. but this is gained in 12 months, therefore, in order to find how much is gained in 9 months, after the ſame rate, ſay, if 12 months give 18 l. what will 9 months give? The anſwer will be 13 l. 10 s.

Example 2. If 12 oxen eat up $3\frac{1}{3}$ acres of paſture in four weeks, and 21 oxen eat up ten acres of like paſture in 9 weeks, how many oxen will eat up 24 acres in 18 weeks?

Solution. If 12 oxen eat up $3\frac{1}{3}$ acres in 4 weeks, then by proportion 36 oxen in 4 weeks, or 16 oxen in 9 weeks, or 8 oxen in 18 weeks, will eat up 10 acres, on ſuppoſition that the graſs did not grow. But ſince by reaſon of the growth of the graſs, 21 oxen in 9 weeks can only eat up 10 acres, that growth of the graſs in 10 acres for the laſt 5 weeks will be as much as would be ſufficient to feed the exceſs of 21 oxen above 16, that is, 5 oxen for 9 weeks; or, which is the ſame thing, to feed $\frac{5}{2}$ oxen for 18 weeks; and in 14 weeks (the exceſs of 18 above the firſt 4) the increaſe of the graſs, by analogy, will be ſuch as to be ſufficient to feed 7 oxen for 18 weeks; for it is, 5 weeks : 14 weeks :: $\frac{5}{2}$ oxen : 7 oxen. Wherefore add theſe 7 oxen, which the growth of the graſs alone would ſuffice to feed, to the 8, which the graſs without growth after 4 weeks would feed, and the ſum will be 15 oxen; and laſtly, if 10 acres ſuffice to feed 15 oxen for 18 weeks, then 24 acres will be found ſufficient to feed 36 oxen for the ſame time.

RULE, in a monaſtic ſenſe, a ſyſtem of laws or regulations, whereby religious houſes are governed, and which the religious make a vow, at their entrance, to obſerve. Such are the rules of the Auguſtines, Benedictines, Carthuſians, Franciſcans, &c.

RULES *of Court*, in law, are certain orders made, from time to time, in the courts of law, which attornies are bound to obſerve, in order to avoid confuſion; and both the plaintiff and defendant are at their peril alſo bound to pay obedience to rules made in court relating to the cauſe depending between them.

RULE, or RULER, an inſtrument of wood or metal with ſeveral lines delineated on it, of great uſe in practical menſuration.

When a ruler has the lines of chords, tangents, ſines, &c. it is called a plane ſcale. See SCALE.

The carpenter's joint rule is an inſtrument uſually of box, &c. twenty-four inches long, and one and a half broad; each inch being ſubdivided into eight parts. On the ſame ſide with theſe diviſions, is uſually added Gunter's line of numbers. On the other ſide, are the lines of timber and broad-meaſure; the firſt beginning at 82, and continued to 36, near the other end; the latter is numbered from 7 to 36, 4 inches from the other end.

Uſe of the Carpenter's Joint RULE. The application of the inches, in meaſuring lengths, breadths, &c. is obvious. That of the Gunter's line, ſee under GUNTER'S *Line*.

The uſe of the other ſide is all we need here meddle with: 1. The breadth of any ſurface, as board, glaſs, &c. being given, to find how much in length makes a ſquare foot. Find the number of inches the ſurface is broad, in the line of broad-meaſure, and right againſt it is the number of inches required. Thus, if the ſurface were eight inches broad, eighteen inches will be found to make a ſuperficial foot. Or more readily thus: apply the rule to the breadth of the board, or glaſs, that end, marked 36, being equal with the edge, the other edge of the ſurface will ſhew the inches, and quarters of inches, which go to a ſquare foot. 2. Uſe of the table at the end of the board meaſure. If a ſurface be one inch broad, how many inches long will make a ſuperficial foot? Look in the upper row of figures for one inch, and under it in the ſecond row is twelve inches, the anſwer to the queſtion. 3. Uſe of the line of timber-meaſure. This reſembles the former; for having learned how much the piece is ſquare, look for that number on the line of the timber-meaſure; the ſpace thence to the end of the rule is the length which, at that breadth, makes a foot of timber. Thus, if the piece be nine inches ſquare, the length neceſſary to make a ſolid foot of timber, is $21\frac{1}{3}$ inches. If the timber be ſmall, and under nine inches ſquare, ſeek the ſquare in the upper rank of the table, and immediately under it is the feet and inches that make a ſolid foot. If the piece be not exactly ſquare, but broader at one end than the other, the method is to add the two together, and take half the ſum for the ſide of the ſquare. For round timber the method is to girt it round with a ſtring, and to allow the fourth part for the ſide of the ſquare; but this method is erroneous, for hereby you loſe nearly one fifth of the true ſolidity: though this is the method at preſent practiſed in buying and ſelling timber.

The maſon's rule is twelve or fifteen feet long, in order to be applied under the level to regulate the courſes, and make the piedroits equal, &c.

Everard's Sliding RULE has already been deſcribed under the article GAUGING.

Coggeſhal's Sliding RULE is chiefly uſed for meaſuring the ſuperficies and ſolidity of timber, &c. It conſiſts of two rulers, each a foot long, one of which ſlides in a groove made along the middle of the other, as repreſented in plate CX. *fig.* 5.

On the ſliding ſide of the rule are four lines of numbers, three whereof are double; that is, are lines to two radiuſes; and one, a ſingle broken line of numbers: the three firſt, marked A, B, C, are figured 1, 2, 3, &c. to 9; then, 1, 2, 3, &c. to 10; their conſtruction, uſe, &c. being the ſame as thoſe of Everard's ſliding rule. The ſingle line, called the girt line, and marked D,

whoſe radius is equal to the two radiuſes of any of the other lines, is broke for the eaſier meaſurement of timber, and figured 4, 5, 6, 7, 8, 9, 10, 20, 30, &c. From 4 to 5 it is divided into ten parts, and each tenth ſubdivided into 2, and ſo on, from 5 to 6, &c.

On the backſide of the rule are, 1. A line of inch-meaſure, from 1 to 12; each inch being divided and ſubdivided. 2. A line of foot meaſure, conſiſting of one foot, divided into 100 equal parts, and figured 10, 20, 30, &c. The back part of the ſliding piece is divided into inches, halves, &c. and figured from 12 to 24; ſo that, when drawn wholly out, there may be a meaſure of two feet.

Uſe of Coggeſhal's RULE *for Meaſuring plane Superficies.* 1. To meaſure a ſquare, ſuppoſe, for inſtance, each of the ſides 5 feet; ſet 1 on the line B, to 5 on the line A; then againſt 5 on the line B is 25 feet, the content of the ſquare on the line A. 2. To meaſure a long ſquare. Suppoſe the longeſt ſide 18 feet, and the ſhorteſt 10; ſet 1 on the line B, to 10 on the line A; then againſt 18 feet, on the line B, is 180 feet, the contents on the line A. 3. To meaſure a rhombus. Suppoſe the ſide 12 feet, and the length of a perpendicular let fall from one of the obtuſe angles to the oppoſite ſide, 9 feet; ſet 1 on the line B, to 12, the length of the ſide, on the line A; then againſt 9, the length of the perpendicular on the line B, is 108 feet, the content. 4. To meaſure a triangle. Suppoſe the baſe 7 feet, and the length of the perpendicular let fall from the oppoſite angle to the baſe 4 feet; ſet 1 on the line B, to 7 on the line A; then againſt half the perpendicular, which is 2 on the line B, is 14 on the line A, for the content of the triangle. 5. To find the content of a circle, its diameter being given. Suppoſe the diameter 3.5 feet; ſet 11 on the girt line D, to 95 on the line C; then againſt 3.5 feet on D is 9.6 on C, which is the content of the circle in feet. 6. To find the content of an oval or ellipſis. Suppoſe the longeſt diameter 9 feet, and the ſhorteſt 4. Find a mean proportional between the two, by ſetting the greater 9 on the girt line, to 9 on the line C; then againſt the leſs number 4 on the line C is 6, the mean proportional ſought. This done, find the content of a circle, whoſe diameter is 6 feet; this, when found, by the laſt article, will be equal to the content of the ellipſis ſought.

Uſe of Coggeſhal's RULE, *in Meaſuring Timber.* 1°. To meaſure timber the uſual way. Take the length in feet, half feet, and, if required, quarters; then meaſure half way back again; then girt the tree with a ſmall cord or line; double this line twice very evenly, and meaſure this fourth part of the girt or perimeter, in inches, halves, and quarters. The dimenſions thus taken, the timber is to be meaſured as if ſquare, and the fourth of the girt taken for the ſide of the ſquare, thus; ſet 12 on the girt line D, to the length in feet on the line C; then againſt the ſide of the ſquare, on the girt-line D, taken in inches, you have, on the line C, the content of the tree in feet. For an inſtance: ſuppoſe the girt of a tree in the middle, be 60 inches, and the length 30 feet, to find the content, ſet 12 on the girt-line D, and 30 feet on the line C; then againſt 15, one fourth of 60, on the girt-line D, is 46.8 feet, the content on the line C. If the length ſhould be 9 inches, and the quarter of the girt 35 inches; here, as the length is beneath a foot, meaſure it on the line of foot-meaſure, and ſee what decimal part of a foot it makes, which you will find .75. Set 12, therefore, on the girt-line, to 75 on the firſt radius of the line C, and againſt 35 on the girt-line is 64 feet on C, for the content. 2°. To meaſure round timber the true way. The former method, though that generally in uſe, is not quite juſt. To meaſure timber accurately, inſtead of the point 12 on the girt-line, uſe another, viz. 10.635; at which there ſhould be placed a center-pin. This 10 635 is the ſide of a ſquare equal to a circle, whoſe diameter is 12 inches. For an inſtance: ſuppoſe the length 15 feet, and $\frac{1}{4}$ of the girt 42 inches, ſet the point 10.635 to 15, the length; then againſt 42 on the girt-line is 233 feet for the content ſought; whereas, by the common way, there ariſes only 184 feet. In effect, the common meaſure is only to the true meaſure, as 11 to 14. 3°. To meaſure a cube. Suppoſe the ſides to be 6 feet each; ſet 12 on the girt-line D, to 6 on C; then againſt 72 inches, the inches 6 feet on the girt-line, is 216 feet on C, which is the content required. 4°. To meaſure unequally-ſquared timber; that is, where the breadth and depth are not equal. Meaſure the length of the piece, and the depth at the end in inches: then find a mean proportional between the breadth and depth of the piece. This mean proportional is the ſide of a ſquare, equal to the end of the piece; which found, the piece may be meaſured as ſquare timber. For an inſtance: let the length of the piece of timber be 13 feet, the breadth 23 inches, and the depth 13 inches; ſet 23 on the girt-line D, to 23 on C; then againſt 13 on C is 17.35 on the girt-line D, for the mean proportional. Again, ſetting 12 on the girt-line D, to 13 feet, the length of the line C; againſt 17.35 on the girt-line is 27 feet, the content. 5°. To meaſure taper timber. The length being meaſured in feet, note one-third of it; which is found thus: ſet 3 on the line A, to the length on the line B; then againſt 1 on A is the third part on B: then, if the ſolid be round, meaſure the diameter at each end in inches, and ſubtract the leſs diameter from the greater; add half the difference to the leſs diameter; the ſum is the diameter in the middle of the piece. Then ſet 13.54 on the girt to the length of the line C, and againſt the diameter in the middle on the girt-line is a fourth number on the line C. Again, ſet 13.54 on the girt-line to the third part of the length on the line C; then againſt half the difference on the girt-line is another fourth number on the line C; theſe two fourth numbers, added together, give the content. For an inſtance: let the length be 27 feet, one third whereof is 9, the greater diameter 22 inches, and the leſſer 18; the ſum of the two will be 40, their difference 4, and half the difference 2, which, added to the leſs diameter, gives 20 inches for the diameter in the middle of the piece. Now ſet 13.54 on the girt-line, to 27 on the line C, and againſt 20 on D is 58.9 feet. Again, ſet 13.54 of the girt-line to 9 on the line C; and againſt 2 on the girt-line, repreſented by 20, is .196 parts; therefore, by adding 58.9 feet to .196 feet, the ſum is 59.096 feet, the content.

If the timber be ſquare, and have the ſame dimenſions; that is, the length 27 feet, the ſide of the greater end 22 inches, and that of the leſſer 18 inches; to find the content, ſet 12 on the girt-line to 27, the length, on the line C, and againſt 20 inches, the ſide of the mean ſquare on the girt-line, is 75.4 feet. Again, ſet 12 on the girt-line to 9 feet, one third of the length, on the line C, and againſt 2 inches, half the difference of the ſides of the ſquares of the ends on the girt-line, is .25 parts of a foot; both together make 75.65 feet, the content of the ſolid.

The girt or circumference of a tree, or round piece of timber given; to find the ſide of the ſquare within, or the number of inches of a ſide, when the round timber is ſquared. Set 10 on A to 9 on B, then againſt the girt on A are the inches for the ſide of a ſquare on the line B.

RUM, a ſpecies of brandy, or vinous ſpirit diſtilled from ſugar canes.

Rum, according to Dr. Shaw, differs from ſimple ſugar-ſpirit, in that it contains more of the natural flavour, or eſſential oil of the ſugar-cane; a great deal of raw juice and parts of the cane itſelf being often fermented in the liquor, or ſolution, of which the rum is prepared. The unctuous or oily flavour of rum is often ſuppoſed to proceed from the large quantity of fat uſed in boiling the ſugar; which fat, indeed, if coarſe, will uſually give a ſtinking flavour to the ſpirit, in our diſtillations of the ſugar-liquor, or waſh, from our refining ſugar-houſes; but this is nothing of kin to the flavour of the rum, which is really the effect of the natural flavour of the cane.

The method of making rum is this: when a ſufficient ſtock of the materials is got together, they add water to them, and ferment them in the common method, though the fermentation is always carried on very ſlowly at firſt; becauſe, at the beginning of the ſeaſon for making rum in the iſlands, they want yeaſt, or ſome other ferment to make it work; but by degrees, after this, they procure a ſufficient quantity of the ferment, which riſes up as a head

head to the liquor in the operation, and thus they are able afterwards to ferment and make their rum with a great deal of expedition, and in large quantities.

When the waſh is fully fermented, or to a due degree of acidity, the diſtillation is carried on in the common way, and the ſpirit is made up proof; though ſometimes it is reduced to a much greater ſtrength, nearly approaching to that of alcohol or ſpirit of wine, and it is thus called double diſtilled rum. It might be eaſy to rectify the ſpirit, and bring it to much greater purity than we uſually find it to be of; for it brings over in the diſtillation a very large quantity of the oil; and this is often ſo diſagreeable, that the rum muſt be ſuffered to lie by a long time to mellow before it can be uſed; whereas, if well rectified, it would grow mellow much ſooner, and would have a much leſs potent flavour.

The beſt ſtate to keep rum in, both for exportation and other uſes, is doubtleſs that of alcohol, or rectified ſpirit. In this manner it would be tranſported in one-half the bulk it uſually is, and might be let down to the common-proof-ſtrength with water when neceſſary: for the common uſe of making punch, it would likewiſe ſerve much better in the ſtate of alcohol; as the taſte would be cleaner; and the ſtrength might always be regulated to a much greater exactneſs than in the ordinary way.

The only uſe to which it would not ſo well ſerve in this ſtate, would be the common practice of adulteration among our diſtillers; for when they want to mix a large portion of cheaper ſpirit with the rum, their buſineſs is to have it of the proof ſtrength, and as full of the flavouring oil as they can, that it may drown the flavour of the ſpirits they mix with it, and extend its own. If the buſineſs of rectifying rum was more nicely managed, it ſeems a very practicable ſcheme to throw out ſo much of the oil, as to have it in the fine light ſtate of a clear ſpirit, but lightly impregnated with it; in this caſe it would very nearly reſemble arrac, as is proved by the mixing a very ſmall quantity of it with a taſteleſs ſpirit, in which caſe the whole bears a very near reſemblance to arrac in flavour.

Rum is uſually very much adulterated in England; ſome are ſo bare-faced as to do it with malt-ſpirit: the taſtes of both are ſo nearly allied, that it is not eaſily diſcovered. The beſt method of judging of it is, by ſetting fire to a little of it; and when it has burnt away all the inflammable part, examining the phlegm both by the taſte and ſmell.

A very ingenious gentleman has favoured us with his opinion in regard to the method of imitating the rum brought from the Weſt Indian iſlands, or rather of making the ſame elſewhere.

The reaſon of this conſideration, ſays he, is founded on a well known fact, viz. that from melaſſes, or the ſame ingredients as are made uſe of in the iſlands where the beſt rum is made, when they are diſtilled here, a ſpirit ſo different is obtained, that it is not even pretended to be rum at all, but bears the denomination of melaſſes ſpirits; and, in the northern colonies of America, alſo, only a very inferior kind of rum is produced from the ſame ingredients. Now it is certainly a ſpeculation of ſome utility, as well as curioſity, to determine to what this difference is owing: and to know, if it can be done, how to produce rum here, inſtead of the common melaſſes ſpirits, from the melaſſes; and, in North America, to make ſuch as is equal to that diſtilled in the iſlands.

The cauſe why melaſſes affords rum in the iſlands, and a ſpirit of a different kind here, or of the ſame kind, but not equally good, in North America, has been aſcribed to three principles.

The firſt is, that the fermentation renders the ſpirit different, in this manner, from the effect of the difference of climate. The ſecond is, that the melaſſes being uſed there while new, are then in a better ſtate for this purpoſe. The third is, that the diſtilling the rum in large veſſels, and ſuffering part of the melaſſes and feculences to adhere to the ſtill, as is practiſed in the iſlands, occaſions a part of the melaſſes to be burnt, and conſequently to produce a conſiderable quantity of empyreumatic oil of a peculiar kind, which, riſing with the vinous ſpirit, mixes with it, and gives it the particular flavour, and oily nature of rum.

As to the firſt reaſon, or the difference of fermentation in the Weſt Indies, and here, it might account for ſome variation in the produce: but, certainly, not ſuch as is really found in the caſe of rum and melaſſes ſpirit. The great diſſimilitude betwixt them lies, in the firſt wholly wanting that acido-dulcid taſte, and oily conſiſtence, that is found in the other; and which is obviouſly owing to part of the melaſſes being burnt; and affording an empyreumatic oil, that cannot be the product of any mode of fermentation, but muſt be the effect only of a conſiderable degree of heat, either during, or before the diſtillation.

The ſame may be alleged, as to the ſecond aſſigned reaſon of this difference, or the newneſs and freſhneſs of the melaſſes. For all that would reſult from thence would be, that the new would be leſs acid than the older, which could only make a ſmall variation in the ſpirit produced, and that of a very different nature from what is really perceived betwixt our melaſſes ſpirits and rum; for, it is well known, by thoſe who practiſe imitations of brandy and rum, that acids dulcify the ſpirit, and render it leſs fiery, and more gentle; and, in the counterfeit rum, a conſiderable quantity of oil of vitriol is therefore uſed, to deſtroy the taſte of empyreuma, or faints, as it is called, of the malt ſpirit, and gives it a ſoftneſs; ſo that, inſtead of rendering the ſpirit more unlike rum, the keeping the melaſſes, till they tend towards an acid ſtate, would rather promote the reſemblance. The peculiar oily conſiſtence, and flavour of rum, can certainly never be the conſequence of uſing the melaſſes in a freſher or ſtaler ſtate. For, if it had been ſo, the fact would ſoon have ſhewn itſelf, by the difference of the melaſſes ſpirits diſtilled here; which muſt, of courſe, in ſome caſes, have approached nearly to, or actually have been good rum: as it may be ſuppoſed, the melaſſes muſt ſometimes have been uſed as newly here, as in the Weſt India iſlands; and this would neceſſarily have led to their being always uſed ſo, if ſuch an advantageous conſequence had been once known to have attended it.

The laſt reaſon, therefore, or the burning of the melaſſes in the ſtill, if any of the three be, muſt prove the true one. It was firſt hinted, in part, by Mr. Smith, in a pamphlet, as a ſupplement to his work on the Art of Diſtillery. He there aſſerts, as a fact, that it was the general cuſtom for the negroes to omit the perfectly cleanſing the ſtills, which are very large: and, that a great quantity of the feculence and melaſſes adhered, conſequently, to the bottom of them, and was continually burnt; and, to the empyreumatic oil of the ſugar, contained in the melaſſes, and thus burnt, he attributed the peculiar flavour and oilineſs of the rum. Admitting this fact, there can be no doubt but that the difference of rum, from other ſpirits diſtilled from fermented ſugar and melaſſes, muſt conſiſt in this circumſtance; and, indeed, it is evident, from the very flavour and oily nature of the rum itſelf, that the addition of an empyreumatic oil of this kind, really conſtitutes this difference.

If this be allowed, as there is the greateſt reaſon it ſhould, a method naturally preſents itſelf, of bringing any ſpirit, diſtilled, either in Europe or North America, from ſugar or melaſſes, to a very cloſe reſemblance, or rather, perhaps, ſameneſs of nature, with the rum produced in the Weſt-India iſlands.

This method is the burning a proper quantity of ſugar or melaſſes in the due degree; and adding to it the fermented liquor of melaſſes before the diſtillation: by which means it is, on this ſuppoſition, preſumed, that what is wanting, to render the ſpirit diſtilled from ſuch liquor the ſame with rum, muſt be of courſe ſupplied.

The degree of burning, and the proportion of the burnt matter to be added to the fermented liquor, for this purpoſe, muſt depend on experiment; but a few trials would aſcertain it; and if the difference of rum conſiſts in this, as there is great room to think it does, as well from juſt obſervation on the nature of the ſubject, as from Mr. Smith's authority for the fact; the practice of this method might be rendered of commercial utility. The particular advantages of this would here be, by converting what is now

melaſſes

melaſſes ſpirits into rum, and greatly increaſing its marketable value: and, in North America, by enabling diſtillers of rum there to bring theirs to a much greater reſemblance to that of the iſlands; and conſequently to make a much more advantageous return of the melaſſes, they purchaſe by the barter of their own produce: a circumſtance, at preſent, of great conſequence, both to the peace and lucrative intereſt of thoſe colonies.

The rendering rum, by this means, cheaper, would, alſo, tend to the excluſion of thoſe wretched counterfeit kinds, made of malt ſpirits, dulcified with a large proportion of acid, particularly oil of vitriol; which are very injurious to particular conſtitutions. Extreme great quantities of ſuch counterfeit kinds are now vended: and ſo much induſtry has been exerciſed in the art of making them, that the preparing mixtures, for producing the reſemblances of the various genuine ſpirits, is now become a ſeparate trade: and the poſſeſſors of it are called flavour makers. All ſuch practices ought either to be under due regulations, or be wholly prohibited: for, being in the hands of perſons ignorant of the ſalutary or injurious effects of the mixtures they make, ingredients very detrimental may be introduced; and diſpenſed, by this means, amongſt a great number of the common people, who never conſult any thing but their palate, in matters of this nature.

RUMEN, in comparative anatomy, the paunch, or firſt ſtomach of ſuch animals as chew the cud, thence called ruminant animals.

RUN, the after-part of a ſhip's bottom both within or without, which grows narrower as it approaches the ſtern-poſt.

RUNDLE, or ROUNDLE, in heraldry, the ſame with PELLET.

RUNDLET, or RUNLET, a ſmall veſſel containing an uncertain quantity of any liquor, from three to twenty gallons.

RUNNET, or RENNET, the acid juice found in the ſtomachs of calves that have fed on nothing but milk, and are killed before the digeſtion is perfect.

RUNNING *of Goods*, a clandeſtine landing of goods, without paying the legal cuſtoms or duties for the ſame.

RUPEE, ROUPIA, or ROUPIAS, names of gold and ſilver coin, current in the Eaſt Indies.

RUPTURE, in ſurgery, the ſame with hernia. See HERNIA.

RURAL, or RUSTIC, in general, denotes ſomething that relates to the country.

RUSSIA, or MUSCOVY, a large empire, comprehending a vaſt extent of country, in the moſt northerly parts of Europe and Aſia, from twenty to one hundred and thirty degrees of eaſt longitude, and between forty-five and ſeventy-two degrees of north latitude.

RUST *of a Metal*, the flower or calx thereof, procured by corroding and diſſolving its ſuperficial parts by ſome menſtruum. Water is the great inſtrument or agent in prodcing ruſt; and hence oils, and other fatty bodies, ſecure metals from ruſt; water being no menſtruum to oil, &c. and therefore not able to make its way through it.

All metals are liable to ruſt, even gold itſelf, if expoſed to the fumes of ſea-ſalt.

RUST *of Corn*, in huſbandry, the name given by our farmers to a diſeaſe in corn or other vegetables, in which their ſtalks and leaves ſeem burnt up, and appear of a ſort of ruſt colour.

Wheat is blighted at two ſeaſons, firſt in the bloſſom, and then its generation is prevented, many of the huſks being empty in the ear, and the rudiments of the grains not impregnated: ſecondly, wheat is blighted when the grains are brought to maturity; and in this caſe they become light, and are of little value for making of bread, having ſcarce any flour in them.

The firſt of theſe cannot happen in England from froſts, becauſe our wheat is not in flower till the month of June; but it is long and continual rains that chill the bloſſoms, and in this manner prevent their fertility: this, however, does not often happen to us; theſe rains are not common at this ſeaſon of the year; and, if they were, this country lying much of it open, the winds diſlodge theſe drops of water from the ears, and prevent the miſchief they would do there.

Lammas wheat does not retain theſe drops ſo long as the bearded or cone wheat; and, in conſequence of this in the terrible blight in England, in the year 1725, the bearded wheat received infinitely greater miſchief than the Lammas wheat.

The ſecond kind of blight from light ears, is that which is more frequent, and more general with us; this brings the greateſt ſcarcity of wheat, and the cauſe of this is plainly want of nouriſhment of the grain, by whatever means that want is occaſioned. Several accidents kill the plants, or injure their health, and in that caſe the grains are not filled; lightning does great miſchief to the farmer in this kind, as is plain by the ſeveral black ſpots and patches in fields of corn, in years when there has been more lightning than uſual. This is a diſaſter that muſt be quietly ſuffered, ſince it can neither be prevented nor remedied; but the other cauſes of blights, which are moſt general, and do the moſt damage, may be prevented in ſome meaſure at leaſt.

One great and common cauſe of the blight is the lodging or falling of corn; in this caſe the ſtalks are broken near the ear, and the veſſels are hurt which ſhould carry up the nouriſhment to the ear. In this caſe, there can juſt juices enough paſs for the keeping the plant alive, and bringing it to its full height, but it is languid all the time, and the grains can never be filled with flour. The earlier in the ſeaſon this lodging of the ſtalks happens, the thinner and poorer the ears will be: hence it happens, that when dung and tillage have brought a wheat land into ſo good a ſtate, that in April and May it ſeems to promiſe the farmer five or ſix quarters of wheat, it ſhall all be deſtroyed by falling in June, and ſcarce yield him five buſhels, and this is ſo thin and lank, that the expences of reaping and threſhing are more than its value. The wind is generally accuſed of the throwing down theſe ſtalks; but this does not ſeem to be truly the caſe; the wind may preſs upon the plants; but the cauſe of their giving way to it is a weakneſs in their ſtalks, and this ſeems either owing to the want of nouriſhment, or the want of air, or of the ſun's rays, and perhaps the want of all three together. A rich acre will maintain a crop of five quarters ſtanding, while a poor acre will not be able to ſupport ſuch a crop, as would have yielded only about three quarters, had it ſtood. This is a proof of want of due nouriſhment being one great cauſe of the falling. Air is neceſſary to the nouriſhment of all plants; wheat in particular requires a very free air. It ſucceeds beſt in open hilly places where the wind comes freely to it, and ſhakes off the drops of water from the leaves, as well as their own recrements; and it is plain, that a great quantity of the ſun's rays is neceſſary to keep the wheat ſtrong; becauſe in the hotter countries it is not ſo ſubject to fall, as it is with us, and in other northern countries.

There is another cauſe of the blight, which is the wheat's coming too late into bloſſom. It ſhould bloſſom in the beginning of June, becauſe there is not otherwiſe time, during the hot weather, for it to paſs through the different ſtages to the perfection of the grain.

The cauſes of the blight being thus known, the cure or prevention may be attempted by the farmer on much more rational grounds than it was among the antients. It is advantageous to haſten as much as poſſible the time of bloſſoming of the corn, and to protract, as long as we can, the ripening of the grain, that it may have ſufficient time to fill and ſwell.

The earlieſt ſown wheat is generally obſerved to eſcape the beſt, and this is owing to its coming ſooneſt into bloſſom.

The antients uſed to let their ſheep feed upon the corn while young in the blade, by way of preventing it from lodging or falling afterwards: ſome of our own farmers uſe this method alſo; and it is true, that the corn is prevented from falling by this; but the remedy is as bad as the diſeaſe, for the ſtalks are not made very ſtrong by this practice, but the ears lighter. They therefore do not weigh down and lodge the ſtalks indeed, but they are in ſome ſort blighted by this means, and the diſeaſe is cauſed by the means uſed to prevent it. This feeding down the wheat with ſheep retards the time of its bloſſoming, and the only advantage of early ſowing is thus

taken

taken away by it: what grows after the eating of the ſheep is a ſort of latter crop, and is always weaker and later than the firſt.

The longer the corn remains on the ground, the more nouriſhment it requires from it; and, in this unnatural remaining on the land, there is no proper ſupply provided.

The general remedy for all the caſes of the blight is the modern method of horſe-hoeing huſbandry. In this the hoe ſtirs up the ground as often as the farmer pleaſes, and every ſuch ſtirring gives new life and nouriſhment to the plant: this, as a ſupply of food for the ear, may be given, whenever it is neceſſary, and the wide intervals left for the hoe in the drilling the wheat; for this ſort of huſbandry gives a free paſſage for the ſun and air to all the plants.

The moſt general blight of all that happen in theſe cold countries is cauſed by inſects, which ſome think are brought in the air by an eaſt-wind, accompanied by moiſture, a little before the grain is filling with that milky juice which hardens into flour. Theſe inſects depoſit their eggs within the outer ſkin or rind of the ſtalks; and when the young ones are hatched, they feed on the parenchyma, and eat off many of the veſſels which ſhould convey this juice; then the ear is deprived of it, and muſt in conſequence be thin and poor, in proportion to the number of the veſſels eaten, and as the inſects happen to come earlier or later; for ſometimes they come ſo late, that the grains are ſufficiently filled with this milky juice before they have any power to hurt the veſſels.

In this caſe, though the ſtraw, when examined by the microſcope, appears to have its veſſels eaten and torn, and to be full of black ſpecks, which are cauſed by the ſame inſects, yet the grain is plump and full. This is one of the many caſes in which the early ſown wheat eſcapes the blight. It has been ſeen, that, of the crop of wheat in the ſame field, ſome of which has been ſown earlier and ſome later, tho' there has been no difference in the whole, yet the early ſown wheat has been full-eared, and the late ſown has been light-eared; and both have had their ſtalks equally eaten and ſpotted by the inſects.

A proof that theſe miſchievous inſects are brought by the eaſt wind, is, that the corn on the eaſt ſide of hedges is often found blighted, and deſtroyed by them, while that on the weſt ſide of the ſame hedge is unhurt. Some ſuppoſe they are bred in the earth, and crawl up the ſtalks, becauſe ſome whole fields are ſubject to them, and others eſcape them wholly; but this is more probably owing to the difference of the ſituation of theſe fields, as they are more or leſs expoſed to the eaſt.

Some wheat is more liable to be hurt by this inſect blight than another, and the beſt remedy in this evil is to plant fields, which are moſt expoſed to theſe blights, with ſuch wheat as is leaſt ſubject to be injured by them. The white cone, or bearded wheat, which has its ſtalk or ſtraw like a ruſh, not hollow, but full of pith, except near the lower part, where it is very thick and ſtrong, is very proper on this occaſion; it is probable that this plant has ſap veſſels, that lie deeper, and ſo are not to be deſtroyed like thoſe of common wheat: the ſtalks of this are often found ſpotted with black, which ſhews that the inſects have been there, and yet the ears are found full, and the grains plump in them.

There is another kind of blight, called by the farmers moor loor; this is occaſioned by the earth's falling away from the roots of the wheat, and is cured by throwing up ſmall furrows againſt the rows in the drilling method. The horſe-hoeing huſbandry is beſt of all others calculated to prevent blights, and to cure them when they happen; but, as there are ſome years when all wheat is blighted, even at theſe times, the horſe-hoeing huſbandry has an advantage; for, when the ſtalks fall, they never lie abſolutely on the ground in this caſe, but the air has room to play between them; but the common ſown wheat has not this advantage. The ears in the blighted wheat of the drilled kind are not ſo light nor poor as in others, but make the farmer ſome amends in the corn, though greatly leſs than in the common produce. *Tull's Horſe-hoeing Huſbandry.*

Corn is always more ſubject to blights after a wet ſummer than at any other ſeaſon; the reaſon ſeems, that, the roots being continually drenched with water, the plant runs up to ſtalk, and has very little ear, and the corn is never large or full.

It is obſerved, that when the mildews riſe, or blights fall, they generally infeſt only one kind of grain, ſometimes wheat, ſometimes oats, and ſometimes barley only; and the ſame ſort of obſervation holds good in regard to fruit; ſometimes only apples are blighted, ſometimes only pears, ſometimes cherries, and ſo on. *Mortimer's Huſbandry.*

RUSTIC, in architecture, implies a manner of building in imitation of nature, rather than according to the rules of art.

Rustic Work, is where the ſtones in the face, &c. of a building, inſtead of being ſmooth, are hatched, or picked with the point of a hammer.

Rustic Order, that decorated with ruſtic quoins, ruſtic work, &c.

RUSTRE, in heraldry, a bearing of a diamond-ſhape, pierced through in the middle with a round hole.

RUT, in hunting, the venery, or copulation of deer.

RUE, *Ruta*, in the materia medica, a ſmall ſhrubby plant, with thick bluiſh leaves divided into numerous roundiſh ſegments: on the tops of the branches come forth yellowiſh tetrapetalous, ſometimes pentapetalous, flowers followed each by a capſule, which is divided into four partitions full of ſmall blackiſh rough ſeeds. It is cultivated in gardens, flowers in June, and holds its leaves all the winter. The markets are frequently ſupplied with a narrow-leaved ſort, which is cultivated in preference to the other, on account of its appearing variegated during the winter with white ſtreaks.

This herb has a ſtrong unpleaſant ſmell, and a penetrating pungent bitteriſh taſte: much handled, it is apt to inflame and exulcerate the ſkin. It is recommended as a powerful ſtimulant, aperient, antiſeptic, and as poſſeſſing ſome degree of an antiſpaſmodic power; in crudities and indigeſtion, for preſerving againſt contagious diſeaſes and the ill effects of corrupted air, in uterine obſtructions and hyſteric complaints, and externally in diſcutient and antiſeptic fomentations. Among the common people, the leaves are ſometimes taken with treacle on an empty ſtomach, as an anthelmintic. A conſerve, made by beating the freſh leaves with thrice their weight of fine ſugar, is the moſt commodious form for the exhibition of the herb in ſubſtance.

The virtues of rue are extracted both by water and rectified ſpirit, moſt perfectly by the latter: the watry infuſions are of a greeniſh yellow or browniſh; the ſpirituous, made from the freſh leaves, of a deep green; from the dry, of a dark yellowiſh brown colour. The leaves themſelves, in drying, change their bluiſh green colour to a yellow. On inſpiſſating the ſpirituous tincture, very little of its flavour riſes with the menſtruum; nearly all the active parts of the rue remaining concentrated in the extract, which impreſſes on the palate a very warm, ſubtile, durable pungency, and is in ſmell rather leſs unpleaſant than the herb in ſubſtance. In diſtillation with water, an eſſential oil ſeparates; in colour yellowiſh or browniſh, in taſte moderately acid, and of a very penetrating ſmell, rather more unpleaſant than that of the herb: a very conſiderable part of the virtue of the rue remains behind; the decoction, inſpiſſated, yielding a moderately warm, pungent, bitteriſh extract. The active matter of this plant appears therefore to be chiefly of the more fixed kind: the eſſential oil itſelf is not very volatile, or at beſt, is ſo ſtrongly locked up by the other principles, as not to be readily elevated in diſtillation. The ſeeds, and their capſules, appear to contain more oil than the leaves.

Goat Rue, galego, a plant with a papilionaceous flower, and a long cylindric pod for its fruit.

It has been accounted a good ſudorific, but is little uſed in the preſent practice.

RYE, *Secale*, in botany, a genus of plants, the corolla of which conſiſts of two valves; the exterior valve is rigid, ventricoſe, acuminated and compreſſed, its lower edge is ciliated, and it terminates in a long ariſta: the interior valve is lanceolated and plane; the corolla ſerves

the office of a pericarpium, incloſing the ſeed, and, at a proper time, opening and dropping it out; the ſeed is ſingle, oblong, and almoſt cylindric.

This ſort of grain ſucceeds very well on any ſort of dry land, even on the moſt barren gravel or ſand. The farmers ſow it about the beginning of September, after a ſummer's fallow, in the drieſt time they can. Two buſhels of ſeed is the quantity generally allowed to an acre of land; but if it be ground newly broken up, or if it be ſubject to worms, they then allow a peck more to the acre. A little ſprinkling of dung, or mud, upon rye-land, will greatly advance the crop, though it is laid but half the thickneſs that it is for other corn; its produce is commonly about twenty buſhels upon an acre.

The farmer knows it is ripe when the ſtraw is yellow, the ear bends, and the grain feels hard. It is not apt to ſhed the ſeeds; and therefore, if there are many weeds among the crop, it may be left lying upon the ground, or gravel, as they call it, eight or nine days after it is cut, before it is bound up, if the weeds are not dry ſooner: for otherwiſe, they will grow moiſt in the barn, and cauſe the whole to give, and not to thraſh well, and ſometimes they will make it muſty.

As it is a grain that will grow in the ear ſooner than any other if it be wet, care muſt be taken, if rain falls after it is cut, to turn it as it lies upon the ground every other day, and at the ſame time to keep the ears as far from the earth, and as much above the ſtubble, as may be; this will prevent the miſchief. If it be pretty clear of weeds, it may be houſed as ſoon as it is cut. If either this grain or wheat lodge upon the ground, it is beſt to cut them, even though they are not ripe; for the ſtalk being broken will yield no more nouriſhment to the ear.

There is another very eſſential uſe to the farmer made of rye. April is the ſeaſon of the year when food is of all others the ſcarceſt for cattle, eſpecially for ſheep and lambs: on this occaſion ſome ſplit the ridges of the wheat ſtubble, and ſow them with rye; they harrow this in, allowing about a buſhel to an acre; they feed the ſheep with this in April, and in May they plow it up for fallow. *Mortimer's Huſbandry.*

In many parts of France there have been certain years, in which this grain, from no apparent cauſe, has proved noxious, and ſometimes even poiſonous. Mr. Perrault, travelling through Sologne, was informed that the rye of that province was ſometimes ſo corrupted, that thoſe who eat of the bread that had much of the corrupted grain in it, were ſeized with gangrenes in different parts of the body, which was not preceded by any fever, inflammation, or any conſiderable pain; and that the gangrened parts uſually fell off after a time of themſelves, without the aſſiſtance of chirurgical inſtruments.

The grains of rye thus degenerated are black on the outſide, and tolerably white within; and, when they are dry, they are harder and cloſer than the natural good grain: they have no ill taſte, but ſometimes they have a viſcous metallic like honey hanging to one end of them. They grow longer than the other grains in the ſame ear, and are found, from one or two, to ſeven or eight in the ſame ear. Some have ſuppoſed that theſe were not the proper ſeeds of the plant, but ſome other extraneous bodies that got in among them; but it is evident, from a cloſe inſpection, that they are really the genuine ſeeds only altered by ſome accident; the coats, and the furrow, and even the germen for the young plant, being entirely the ſame as in the natural ſeeds.

The places where the rye is found to degenerate in this manner, are all a dry and ſandy ſoil. In theſe places there is ſcarce any ſoil in which more or leſs of theſe large ſeeds are not found among the others, but, when there are but few of them, the ill effects are not perceived. The ſeaſon when the degeneracy is greateſt, and the effects the worſt of all, is, when there have been exceſſive rains in the ſpring, and there come on exceſſive heats in the ſucceeding ſummer.

The bread which is made of the rye that holds ever ſo much of this bad corn, is not diſtinguiſhable from other rye bread by the taſte, and ſeldom produces its ill effect, till ſome conſiderable time after it is taken. Beſides the gangrenes already mentioned, it not unfrequently brings on other bad conſequences, ſuch as drying up the milk of women who give ſuck, and occaſioning ſometimes malignant fevers, accompanied with drowſineſs, ravings, and other dangerous ſymptoms.

The part uſually ſeized by the gangrene is the legs, and this often in a very frightful manner. The arms are the parts moſt ſubject next, but all the other parts of the body are ſubject to it.

The firſt ſymptom of this approaching gangrene is a ſtupefaction and deadneſs in the part; after this there comes on ſome pain, though not violent, and the ſkin becomes livid; ſometimes the ſkin ſhews no mark of it, but the pain and ſwelling increaſe; and it is neceſſary to make an inciſion into the fleſh to find the gangrened part. In the more deſperate caſes, the only remedy is the taking off the part; and, if this is neglected, the fleſh is all waſted, and the ſkin becomes black, and clings round the bones, and the gangrene appears again in the ſhoulders.

The poorer people are only ſubject to this diſeaſe; and, as they principally eat the rye bread, and as thoſe years when there is moſt of this bad grain among the ears of rye produce moſt of theſe diſorders, it has been judged certain that the rye is the occaſion of it. It may deſerve enquiry, however, whether that grain may not be innocent of the miſchief, and its degeneracy and the diſtemperature attributed to it may not both be the effect of the ſame bad conſtitution of the air. If it proves, on enquiry, that only thoſe who eat of the rye are ſubject to the diſeaſe, it will ſeem a proof of its really being owing to it; and in this caſe the miſchief may be prevented by the ſifting the grain before it is ground, the degenerated grains being ſo long that they will all remain in the ſieve that lets the other through. The experiment has been made on the ſpot, by giving the flour of the corrupted grains alone to animals; but it is ſaid, they have been killed by it. *Phil. Tranſ.* N°. 130.

S.

S.

SAB

S a conſonant, and the eighteenth letter of the alphabet. This letter was uſed in the ſame form by the ancient Greeks, as appears from the Sigean inſcription, only in an inverted poſition. Its ſound is formed by driving the breath through a narrow paſſage between the palate and the tongue elevated near it, together with a motion of the lower jaw towards the upper, the lips being a little way open, with ſuch a ſpecial configuration of every part of the mouth and larynx as renders the voice ſomething ſibilous or hiſſing. The old and new orthography of the French differ chiefly in the uſe of the *s*; the latter omitting it in writing where it is not heard in pronunciation, and the former retaining it. Thus the followers of the one, particularly the Academy in their dictionary, *tempeſte*, *huiſtre*, *fuſte*, thoſe of the other, *tempête*, *huître*, *fûte*.

S, among the ancients, was a numerical letter, ſignifying ſeven.

S. A. in medical preſcriptions, is an abbreviation of *ſecundum artem*, according to the rules of art; chiefly uſed where ſome uncommon care and dexterity is required.

SABÆANS, in church hiſtory, a ſet of idolators, much ancienter than the Jewiſh law.

In the early ages of the world, idolatry was divided between two ſects; the worſhippers of images called Sabæans, or Sabians, and the worſhippers of fire called magi. See MAGI.

The Sabæans began with worſhipping the heavenly bodies, which they fancied were animated by inferior deities. In the conſecration of their images, they uſed many incantations to draw down into them from the ſtars thoſe intelligences, for whom they erected them, whoſe power and influence they held afterwards dwelt in them. This religion, it is ſaid, firſt began among the Chaldæans, with their knowledge in aſtronomy: and from this it was, that Abraham ſeparated himſelf, when he came out of Chaldæa. From the Chaldæans it ſpread all over the Eaſt; and from thence to the Grecians, who propagated it to all the nations of the known world. The remainder of this ſect ſtill ſubſiſts in the Eaſt, and pretend to derive their name from Sabius, a ſon of Seth; and among the books in which the doctrines of this ſect are contained, they have one which they call the Book of Seth, and which they pretend was written by that patriarch.

SABBATH, or the day of reſt, a ſolemn feſtival of the Jews, on the ſeventh day of the week, or Saturday, beginning from ſun-ſet on Friday, to ſun-ſet on Saturday.

The obſervation of the ſabbath began with the world: for God having employed ſix days in its creation, appointed the ſeventh, as a day of reſt to be obſerved by man, in commemoration of that great event. On this day the Jews were commanded to abſtain from all labour, and to give reſt to their cattle. They were not allowed to go out of the city farther than two thouſand cubits, or about a mile; a cuſtom which was founded on the diſtance of the ark from the tents of the Iſraelites, in the wilderneſs, after their leaving Egypt; for being permitted to go, even on the ſabbath-day, to the tabernacle to pray, they from thence inferred, that the taking a journey of no greater length, though on a different account, could not be a breach of the ſabbatical reſt.

As the ſeventh day was a day of reſt to the people, ſo was the ſeventh year to the land; it being unlawful in this year to plow or ſow, and whatever the earth produced, belonged to the poor; this was called the ſabbatical year. The Jews, therefore, were obliged, during the ſix years, and more eſpecially the laſt, to lay up a ſufficient ſtore for the ſabbatical year.

The modern, as well as the ancient, Jews are very ſuperſtitious in the obſervance of the ſabbath; they carry neither arms, nor gold, nor ſilver about them; and are permitted neither to touch theſe, nor a candle, nor any thing belonging to the fire; on which account they light up lamps on Friday, which burn till the end of the ſabbath.

There is at preſent a ſect of Baptiſts called Sabbatarians, from their obſerving the ſeventh day of the week, as a day ſet apart for the worſhip of God: they attempt to juſtify this practice by alleging that the Jewiſh ſabbath was never abrogated in the New Teſtament; and that where God has given a command, it is our duty to obſerve it till he has abrogated or altered it by a new command. See SUNDAY.

SABELLIANS, a ſect of Chriſtians of the third century, that embraced the opinions of Sabellius, a philoſopher of Egypt, who openly taught that there is but one perſon in the godhead.

The Sabellians maintained, that the word and the holy ſpirit are only virtues, and held, that he who is in heaven is the father of all things, deſcended into the virgin, became a child, and was born of her as a ſon; and that having accompliſhed the myſtery of our ſalvation, he diffuſed himſelf on the apoſtles in tongues of fire, and was then denominated the Holy Ghoſt. This they explained by reſembling God to the ſun, the illuminative virtue or quality of which was the word, and its warming virtue the Holy Spirit. The word, they taught, was darted, like a divine ray, to accompliſh the work of redemption; and that, being reaſcended to heaven, the influences of the Father were communicated after a like manner to the apoſtles.

SABINA,

SABINA, ſavin, in botany. See SAVIN.

SABLE, or SABLE ANIMAL, in zoology, a creature of the weaſel kind, called by authors muſtela zibellina.

SABLE, in heraldry, denotes the colour black, in coats of arms belonging to gentlemen; but in thoſe of noblemen it is called a diamond; and in thoſe of ſovereign princes, ſaturn.

It is expreſſed in engraving by perpendicular and horizontal hatches croſſing one another.

SABRE, a kind of ſword or ſcymetar, with a very broad and heavy blade, thick at the back, and a little falcated or crooked towards the point; it is the ordinary weapon worn by the Turks, who are ſaid to be very expert in the uſe of it.

SAC, in law, is ſaid to be an ancient privilege, which the lord of a manor claims of holding his court, in cauſes of treſpaſs among his tenants, and impoſing fines for the ſame.

SACCADE, in the manege, is a jerk more or leſs violent, given by the horſeman to the horſe, in pulling or twitching the reins of the bridle all on a ſudden, and with one pull, and that when a horſe lies heavy upon the hand, or obſtinately arms himſelf.

SACCHARUM SATURNI, SUGAR of LEAD, s thus ordered to be made in the London Diſpenſatory: boil ceruſs with diſtilled vinegar, until the vinegar becomes ſufficiently ſweet; then filter the vinegar through paper, and after due evaporation ſet it to cryſtalize.

Some have ventured to give ſugar of lead internally, in doſes of a few grains, as a ſtyptic, in hæmorrhages, profuſe colliquative ſweats, ſeminal fluxes, the fluor albus, &c. and indeed it muſt be allowed, that it very powerfully reſtrains the diſcharge; but then it occaſions other ſymptoms, often dangerous, and ſometimes fatal; as violent colic pains, obſtinate conſtipations, cramps, tremors, &c. ſo that its internal uſe ſeems by no means innocent.

SACCULUS, in anatomy, a diminutive of ſaccus, ſignifies a little bag.

SACERDOTAL, ſomething belonging to prieſts.

SACK *of Wool*, a quantity of wool containing juſt twenty-two ſtone, and every ſtone fourteen pounds. In Scotland, a ſack is twenty-four ſtone, each ſtone containing ſixteen pounds.

SACK *of Cotton-Wool*, a quantity from one hundred and a half to four hundred weight.

SACKS *of Earth*, in fortification, are canvas-bags filled with earth. They are uſed in making retrenchments in haſte, to place on parapets, or the head of the breaches, &c. or to repair them, when beaten down.

SACKBUT, a muſical inſtrument of the wind-kind, being a ſort of trumpet, though different from the common trumpet both in form and ſize: it is fit to play a baſs, and is contrived to be drawn out or ſhortened, according to the tone required, whether grave or acute.

It takes aſunder in four pieces, and has frequently a wreath in the middle, which is the ſame tube only twice twiſted, or making two circles in the middle of the inſtrument, by which means it is brought down one fourth lower than its natural tone: it has alſo two pieces or branches on the inſide, which do not appear, unleſs drawn out by an iron-bar, and which lengthens it till it hit the tone required.

The ſackbut is uſually eight feet long, without reckoning the circles, and without being drawn out: when it is extended to its full length, it is uſually fifteen feet; the wreath is two feet nine inches in circumference.

SACRAMENT, *Sacramentum*, ſignifies, in general, a ſign of a thing ſacred and holy; and is defined to be an outward and viſible ſign of a ſpiritual grace. Thus there are two objects in a ſacrament, the one the object of the ſenſes, and the other the object of faith: Proteſtants admit only of two ſacraments, baptiſm, and the euchariſt, or Lord's ſupper: but the Roman catholics own ſeven, viz. baptiſm, confirmation, the euchariſt, penance, extreme unction, ordination and marriage.

SACRAMENTARIANS, a name given by the Romaniſts to all ſuch as in their opinion entertain erroneous doctrines of the ſacrament of the Lord's ſupper, and chiefly uſed by way of reproach to Lutherans, Calviniſts, and other proteſtants.

SACRED, ſomething holy, or that is ſolemnly offered and conſecrated to God, with benedictions, unctions, &c.

SACRIFICE, a ſolemn act of religious worſhip, which conſiſted in dedicating or offering up ſomething animate or inanimate on an altar, by the hands of the prieſt, either as an expreſſion of their gratitude to the Deity for ſome ſignal mercy, or to acknowledge their dependance on him, or to conciliate his favour.

The origin of ſacrifices is by ſome aſcribed to the Phœnicians, but Porphyry aſcribes it to the Egyptians, who firſt offered the firſt-fruits of their grounds to the gods, burning them upon an altar of turf: thus in the moſt ancient ſacrifices there were neither living creatures, nor any thing coſtly or magnificent; and no myrrh or frankincenſe. At length they began to burn perfumes; and afterwards men leaving their ancient diet of herbs and roots, and beginning to uſe living creatures for food, they began alſo to change their ſacrifices. The ſcriptures, however, furniſh us with a different account; for Noah, as it is ſaid, ſacrificed animals at his coming out of the ark; and even Abel himſelf ſacrificed the beſt and fatteſt of his flock; but Grotius thinks it more probable that he contented himſelf with making a mere oblation of his lambs, &c. without ſlaying them.

The Jews had two ſorts of ſacrifices, taking the word in its largeſt ſignification: the firſt were offerings of tythes, firſt-fruits, cakes, wine, oil, honey, and the like; and the laſt offerings of ſlaughtered animals. When an Iſraelite offered a loaf or a cake, the prieſt broke it in two parts, and ſetting aſide that half which he reſerved for himſelf, broke the other into crumbs, poured oil, wine, incenſe, and ſalt upon it, and ſpread the whole upon the fire of the altar. If theſe offerings were accompanied with the ſacrifice of an animal, they were thrown upon the victim to be conſumed along with it. If the offerings were of the ears of new corn, they were parched at the fire, rubbed in the hand, and then offered to the prieſt in a veſſel, over which he poured oil, incenſe, wine and ſalt, and then burnt it upon the altar, having firſt taken as much of it, as of right belonged to himſelf.

The principal ſacrifices among the Hebrews conſiſted of bullocks, ſheep and goats; but doves and turtles were accepted from thoſe who were not able to bring the other; theſe beaſts were to be perfect and without blemiſh. The rites of ſacrificing were various, all of which are very minutely deſcribed in the books of Moſes.

The manner of ſacrificing among the Greeks and Romans was as follows: In the choice of the victim, they took care that it was without blemiſh or imperfection; its tail was not to be too ſmall at the end; the tongue not black, nor the ears cleft; and that the bull was one that had never been yoked. The victim being pitched upon, they gilt his forehead and horns, eſpecially if a bull, heifer, or cow. The head they alſo adorned with a garland of flowers, a woollen infula or holy fillet, whence hung two rows of chaplets with twiſted ribbands; and on the middle of the body a kind of ſtole, pretty large, hung down on each ſide; the leſſer victims were only adorned with garlands and bundles of flowers, together with white tufts or wreaths.

The victims thus prepared were brought before the altar; the leſſer being driven to the place, and the greater led by an halter; when if they made any ſtruggle or refuſed to go, the reſiſtence was taken for an ill omen, and the ſacrifice frequently was ſet aſide. The victim thus brought was carefully examined, to ſee that there was no defect in it: then the prieſt, clad in his ſacerdotal habit, and accompanied with the ſacrificers and other attendants, and being waſhed and purified according to the ceremonies preſcribed, turned to the right hand and went round the altar, ſprinkling it with meal and holy water, and alſo beſprinkling thoſe who were preſent. Then the cryer proclaimed with a loud voice, Who is here? To which the people replied, Many and good. The prieſt then having exhorted the people to join with him by ſaying, Let us pray, confeſſed his own unworthineſs, acknowledging that he had been guilty of divers ſins;

ſins; for which he begged pardon of the gods, hoping that they would be pleaſed to grant his requeſts, accept the oblations offered them, and ſend them all health and happineſs; and to this general form added petitions for ſuch particular favours as were then deſired. Prayers being ended, the prieſt took a cup of wine, and having taſted it himſelf, cauſed his aſſiſtants to do the like; and then poured forth the remainder between the horns of the victim. Then the prieſt, or the cryer, or ſometimes the moſt honourable perſon in the company, killed the beaſt, by knocking it down, or cutting its throat.

If the ſacrifice was in honour of the celeſtial gods, the throat was turned up towards heaven: but if they ſacrificed to the heroes or infernal gods, the victim was killed with its throat towards the ground. If by accident the beaſt eſcaped the ſtroke, leaped up after it, or expired with pain and difficulty, it was thought to be unacceptable to the gods.

The beaſt being killed, the prieſt inſpected its intrails, and made predictions from them. They then poured wine, together with frankincenſe, into the fire, to increaſe the flame, and then laid the ſacrifice on the altar; which in the primitive times was burnt whole to the gods, and thence called an holocauſt: but, in after-times, only part of the victim was conſumed in the fire, and the remainder reſerved for the ſacrificers; the thighs and ſometimes the entrails being burnt to their honour, the company feaſted upon the reſt. While the ſacrifice was burning, the prieſt, and the perſon who gave the ſacrifice, jointly prayed, laying their hands upon the altar. Sometimes they played upon muſical inſtruments in the time of the ſacrifice, and on ſome occaſions they danced round the altar, ſinging ſacred hymns in honour of the gods.

SACRILEGE, the crime of profaning ſacred things, or thoſe devoted to the ſervice of God.

SACRISTAN, *Sacriſta*, a church officer, otherwiſe called ſexton.

SACRISTY, *Sacriſtia*, in church-hiſtory, an apartment in a church, where the ſacred utenſils were kept: being the ſame with our veſtry.

SACRO-LUMBARIS, in anatomy, one of the extenſor muſcles of the back and loins, has its origin at the os ſacrum and the poſterior ſpine of the ilium, and its termination in the upper part of the ribs.

SACRUM Os, the ſacred bone, in anatomy, the lower extremity of the ſpina dorſi, being a bone of a triangular figure, with a rough ſurface; its ſubſtance is ſpongy, and it has two lateral apophyſes for its articulation with the oſſa innominata, alſo two ſmaller upper apophyſes, with glenoide cavities for the articulation into the lower vertebra; and an inferior apophyſes, for its articulation with the os coccygis: it has alſo a canal, for the end of the ſpinal marrow.

The uſes of this bone are, 1. To ſerve as a baſis to the ſpine. 2. To form the pelvis along with the oſſa innominata, and to defend the parts contained in it. 3. To contain in its ſinus the lower part of the ſpinal marrow, called cauda equina. 4. To give paſſage at its foramina, which are ſometimes four, ſometimes five pair, to the nerves of the inteſtinum rectum, the bladder, and of the parts of generation, and to the large crural and iſchiatic ones. 5. To ſerve as a place of origin to many of the muſcles.

In adults, the os ſacrum is one continued bone; but, in infants, it is almoſt entirely cartilaginous; and in children more grown up, it always conſiſts of ſeveral pieces, the junctures of four or five of which may be ſeen even in adults.

SADDLE is a ſeat upon a horſe's back, contrived for the conveniency of the rider.

SADDLES, amongſt ſeamen, a ſort of wooden crutches nailed on the upper-ſide of the main and fore-yard-arms, whereon to fix the ſtudding-ſail booms, which ſlide out upon them when the ſtudding-ſails are to be ſet.

SADDUCEES, in Jewiſh antiquity, a famous ſect among the ancient Jews, ſo called from their founder Sadoc Antigonus of Socho, preſident of the ſanhedrim at Jeruſalem, and teacher of the law in the principal divinity-ſchool of that city. Having often, in his lectures, aſſerted to his ſcholars, that they ought not to ſerve God in a ſervile manner, with reſpect to reward, but only out of filial love and fear; two of his ſcholars, Sadoc and Baithus, inferred from thence, that there were no rewards or puniſhments after this life; and, therefore, ſeparating from the ſchool of their maſter, they taught that there was no reſurrection, nor future ſtate. Many embracing this opinion, gave riſe to the ſect of the Sadducees, who were a kind of Epicureans, but differing from them in this, that though they denied a future ſtate, yet they allowed the world was created by the power of God, and governed by his providence; whereas the followers of Epicurus denied both.

The Sadducees denied all manner of predeſtination whatever, and not only rejected all unwritten traditions, but alſo all the books of the Old Teſtament, excepting the Pentateuch.

SAFE-CONDUCT, a ſecurity given by the king under the great ſeal to a foreigner, for his ſafe coming into and paſſing out of the kingdom.

SAFE-GUARD, a protection formerly granted to a ſtranger, who feared violence from ſome of the king's ſubjects, for ſeeking his right by courſe of law.

SAFFRON, *Crocus*, in botany, &c. See the article CROCUS.

SAGAPENUM, in pharmacy, &c. the concrete gummy-reſinous juice of an oriental plant, of which we have no certain account, but which appears, from the ſeeds and pieces of ſtalks ſometimes found among the juice as brought to us, to be of the ferulaceous or umbelliferous kind. The ſagapenum comes immediately from Alexandria: either in diſtinct tears, or run together into large maſſes; outwardly of a yellow colour, internally ſomewhat paler, and clear like horn; growing ſoft on being handled, ſo as to ſtick to the fingers. It is ſometimes ſupplied in the ſhops by the larger and darker coloured maſſes of bdellium broken in pieces; which greatly reſemble it in appearance, but may be diſtinguiſhed by their much weaker ſmell.

Sagapenum has a ſtrong diſagreeable ſmell, ſomewhat of the leek kind, or like that of a mixture of galbanum with a little aſafetida; and a moderately hot biting taſte. It is one of the ſtrongeſt of the deobſtruent gums, and frequently preſcribed, either by itſelf, or in conjunction with ammoniacum or galbanum, in hyſteric caſes, uterine obſtructions, aſthmas, and other diſorders. It may be commodiouſly taken in the form of pills, from two or three grains to a ſcruple or half a dram: In doſes of a dram, it looſens the belly.

SAGATHEE, in commerce, a ſlight kind of woollen ſtuff, ſerge, or ratteen, ſometimes mixed with a little ſilk.

SAGE, *Salvia*, in botany, a low ſhrubby plant, with ſquare ſtalks, obtuſe wrinkled dry leaves ſet in pairs, and large bluiſh labiated flowers, in looſe ſpikes on the tops of the branches: the upper lip of the flower is nipt at the extremity, the lower divided into three ſegments. It is a native of the ſouthern parts of Europe, common in our gardens, and flowers in June.

There are two ſpecies of ſage, namely, the common ſage, and the ſmall ſage, or ſage of virtue.

Common ſage with the leaves nearly oval, but acuminated, is ſometimes green and ſometimes red: both the green and red ſorts riſe from the ſeeds of one and the ſame plant.

Small ſage, or ſage of virtue, with narrow leaves, is generally whitiſh, never red, and moſt of them have at the bottom a piece ſtanding out at each ſide in the form of ears.

The leaves and tops of ſage are moderately aromatic and corroborant, and uſed in debilities and relaxations both of the nervous and vaſcular ſyſtem. Their ſmell is pretty ſtrong and not diſagreeable; their taſte ſomewhat warm, bitteriſh, and ſubaſtringent: with ſolution of chalybeate vitriol, they ſtrike a deep black colour. The ſecond ſort is both in ſmell and taſte the ſtrongeſt, the firſt moſt agreeable. Of both kinds, the flowers are weaker and more grateful than the leaves; and the cup of the flower ſtronger, and obviouſly more reſinous, than any other part.

The leaves of ſage give out their virtue both to water and rectified ſpirit, moſt perfectly to the latter: to the

former they impart a browniſh, to the latter a dark green tincture. The watery infuſion is often uſed as tea, and often acidulated with a little lemon juice for a diluent in febrile diſtempers: the ſpirituous tincture is in taſte ſtronger than the watery, but the ſmell of the ſage is by this menſtruum covered or ſuppreſſed.

SAGENE, a Ruſſian long meaſure, five hundred of which make a werſt: the ſagene is equal to ſeven Engliſh feet.

SAGITTA, in aſtronomy, the arrow, or dart, a conſtellation of the northern hemiſphere, near the eagle; conſiſting of five ſtars, according to Ptolemy and Tycho; but in Mr. Flamſtead's catalogue, of no leſs than twenty-three.

SAGITTA, in botany, implies the top of any ſmall twig, cyon, or graft of a tree.

SAGITTA, in trigonometry, the ſame with the verſed ſine of an arch.

SAGITTAL *Suture*, in anatomy, the ſecond of the genuine ſutures of the cranium or ſkull.

SAGITTARIES, the ARCHER, in aſtronomy, the ninth ſign of the zodiac. See ZODIAC.

The ſtars in this conſtellation in Ptolemy's catalogue are thirty-two, in Tycho's ſixteen, and in Mr. Flamſteed's fifty-two.

SAGO, a ſimple brought from the Eaſt-Indies, of conſiderable uſe in diet as a reſtorative.

Sago is a ſort of bread produced in the following manner, from a tree called landan, growing in the Moluccas. When a tree is felled, they cleave it in two in the middle, and dig out the pith, which is eatable, when it comes freſh out of the tree. They pound it in a mortar, till it is reduced into a kind of powder ſomewhat like meal. Then they put it in a ſearce made of the bark of the ſame tree, placing it over a ciſtern made of its leaves, and pour water on it, which ſeparates the pure part of the powder from the woody fibres wherewith the pith abounds. The flour thus filtrated they call ſagu, which they make into paſte, and bake it in earthen furnaces.

SAILING, in a general ſenſe, implies the art or act of navigating; or of determining the various motions of a ſhip, and her true place at any time.

Plane, or *Plain* SAILING, is that performed by means of the plane chart. See *Plane* CHART.

Before we proceed to ſhew the method of ſolving the ſeveral caſes of plane ſailing, it may be neceſſary to obſerve, that the diſtance ſailed, difference of latitude, and the departure, or difference of longitude, conſtantly form a right-angled triangle, and the courſe ſteered, and the complement of the courſe, are the two oblique angles of the ſame triangle. For ſuppoſe a ſhip at L (plate CX. *fig* 6.) ſails on a direct courſe till ſhe arrives at M; then will L M repreſent the diſtance ſailed, L N the difference of latitude, N M the departure, or difference of longitude, and the angle N L M the courſe ſteered, conſtituting the right-angled triangle L M N, right-angled at N. Whence it follows, that, if any two of theſe are given, we can by trigonometry find the reſt.

Caſe I. One latitude, courſe, and diſtance ſailed being given, to find the other latitude; and departure from the meridian.

Example. Suppoſe a ſhip, in the latitude of 4 deg. 10 min. north, ſails S. S. W. 194 miles; required the latitude ſhe is in, and how far ſhe hath departed from her former meridian?

Geometrically. Let the place of the ſhip be O (ſee plate CX. *fig.* 7.) draw the meridian O P, and the right-line O Q, forming an angle with the meridian O P = 22 deg. 30 min. = 2 points, the courſe ſteered; ſet off on the line O Q 194 miles, the diſtance ſailed, from O to Q; from the point Q let fall the perpendicular Q P, on the meridian O P, and the triangle is conſtructed; and the lines O P and P Q, the difference of latitude and departure, may be meaſured by applying them to graduated lines on the chart, or to the ſame ſcale of equal parts which O Q was taken from.

Arithmetically. 1. For the difference of latitude, or ſide O P, the proportion will be,

As radius —— — —— = 90 d. 00 m. = 10.0000000
To the diſtance O Q —— —— = 194 = 2.2878017
So is the co-ſine of the courſe = 67° 30′ = angle Q = —— —— —— —— —— —— } 9.9656153

To the difference of latitude O P — = 179 = 2,2534170

2. For the departure, or ſide P Q,

As radius —— — —— = 90 d. 00 m. = 10.0000000
To the diſtance ſailed O Q —— — = 194 = 2.2878017
So is the ſine of the courſe 22d. 30m. = angle O = 9.6006997

To P Q, the departure required —- = 77 = 1.8885014

Caſe II. Both latitudes and courſe being given, to find the diſtance and departure.

Example. Suppoſe a ſhip, in the latitude of 3 deg. 10 min. ſouth ſails N. E. by N. till her diſtance of latitude be 2° 20′; required the diſtance ſailed, and departure from the meridian?

Geometrically. Let R (ſee plate CX. *fig.* 8.) be the place the ſhip ſailed from on the chart; draw the meridian R S, ſetting off on it 140 miles = the difference of latitude, from R to S; and erect the perpendicular S T, draw the rhumb-line R T, making an angle with the meridian R S = 33 deg. 45 min. = the courſe ſteered, continuing it till it cut the perpendicular in T; then will T be the place of the ſhip on the chart; and the diſtance R T, and departure S T, may both be meaſured by applying them to the graduated lines, or the ſame ſcale R S was taken from.

1. To find the diſtance ſailed, it will be,

As the comp. of the courſe = 56 d. 15 m. = angle T = —— —— —— —— —— —— } 9.9198464
To the difference of latitude = 140 = R S — = 2.1461280
So is radius —— —— = 90d. —— = 10.0000000

To the diſtance required — = 168,4 = R T = 2.2262816

2. For the departure, the proportion will be,

As radius —— —— = 90 —— —— = 10.0000000
To the diſtance R T —— = 168,4 —— = 2.2262816
So is the ſine of the courſe, or angle R = 33d. 45 m. = —— —— —— —— —— —— } 9.7447390

To S T, the departure required = 93,5 = 1.9710206

Caſe III. Both latitudes and diſtance ſailed being given, to find the courſe and departure.

Example. Admit a ſhip, in the latitude of 1 d. 00 m. ſouth, ſails between the north and eaſt 96 miles, till her difference of latitude be 1°. 10′, required the courſe and departure?

Geometrically. Let V (plate CX. *fig.* 9.) be the place of the ſhip ſailed from on the chart; draw the meridian V W, ſetting off on it 70, the difference of latitude, from V to W, and erect a perpendicular W X; take the diſtance ſailed between the points of the compaſſes, and, ſetting one foot in V, with the other croſs the perpendicular in X, which will be the place the ſhip is arrived at on the chart; and the courſe or angle W V X may be meaſured by the line of chords, and the departure W X by applying it to the graduated lines on the chart, or to the ſame ſcale V X was taken from.

Arithmetically. 1. To find the courſe, or angle W V X, it will be,

As V X the diſtance ſailed —— — = 96 — = 1.9822712
To radius —— —— —- = 90 d. 00 m. = 10.0000000
So is V W, the diff. of latitude = 70 — = 1.8450980

To the S of the angle X, the comp. courſe = 46 d. 49 m. = —— —— — —— —— } 9.8628268

Which being taken from 90d. gives 43d. 11m. the courſe ſteered; and, becauſe the courſe was between the north and eaſt, it is north 43d. 11d. eaſterly, or nearly N. E. by N. 3 quarters eaſterly.

2. For the departure W X, the proportion will be,

As radius — — —— = 90d. 00m. — = 10.0000000
To the diſtance V X —— = 96 —— —— = 1.9822712
So is the ſine of the courſe, or angle V = 43d. 11m. = —— —— —— —— } 9.8352688

To the departure W X —— = 65,7 —— = 1.8175400

Caſe

Caſe IV. Both latitudes and departure being given, to find the courſe and diſtance?

Example. Suppoſe a ſhip, in the latitude 2d. 00m. ſouth, ſails between the ſouth and eaſt, till her difference of latitude be 2° 10′, and her departure 96 miles eaſt; required her direct courſe and diſtance?

Geometrically. Let *a* (plate. CX *fig.* 10) be the firſt place of the ſhip on the chart, draw the meridian *a b*, ſetting off on it 130 miles, the difference of latitude, from *a* to *b*, and erect the perpendicular *b c*, making it =96 miles, the departure from the meridian; through the points *a* and *c*, draw a right-line, and the triangle is conſtructed; and the angle *a* may be meaſured by the line of chords, and the diſtance *ac* by applying it to the graduated lines on the chart.

Arithmetically. 1. To find the courſe, it will be,

As *a b*, the difference of latitude = 130 — = 2.1139434
To radius —— —— —— = 90d. 00m. = 10.0000000
So is *b c* the departure —— —— = 96 = 1.9822712

To the T. of the angle *a*, the courſe required = 36d. 27m. = —— —— —— —— —— } 9.8683278

Which, becauſe ſhe ſailed between the ſouth and eaſt, is ſouth 36d. 27m. eaſterly, or almoſt S. E. by S. one quarter eaſterly.

2. To find the diſtance ſailed, it will be,

As the ſine of the courſe, or angle *a* = 36d. 27m. = — —— —— —— —— —— —— } 9.7738749
Is to the departure *bc* —— — = 96 —— = 1.9822712
So is radius —— —— — = 90d. 00m. = 10.0000000

To *ac*, the diſtance ſailed —— = 161,5 = 2.2083963

Caſe V. One latitude, diſtance, and departure being given, to find the other latitude and courſe ſteered.

Example. A ſhip at ſea, in the latitude of 1d. 00m. north, ſails between the north and weſt 120 miles, having departed to the weſtward of her former meridian 96 miles; required her direct courſe, and the difference of latitude?

Geometrically. Let *d* (plate CX. *fig.* 11.) be the place of the ſhip: draw the meridian *d e*, and parallel to it, at the diſtance of the departure = 96, the line *f g*; take the diſtance ſailed between the points of the compaſſes, and, ſetting one foot in *d*, with the other croſs the former parallel in *h*, which will be the place the ſhip is arrived at; from the point *h*, let fall the perpendicular *h e*, and draw the right-line *d h*; then will *d e* be the difference of latitude, and the angle *d* the courſe; both which may be meaſured as in the former caſe.

Arithmetically. 1. To find the courſe, the proportion will be,

As *dh*, the diſtance ſailed —— = 120 — = 2.0791812
To radius —— —— = 90d. 00m. —— = 10.0000000
So is *e h*, the departure —— = 96 —— = 1.9822712

To the ſine of the courſe, or angle *d* = 53d. 7m. = 9 9030900, that is north 53d. 7m. weſterly, or almoſt N. W 3 quarters weſterly.

2. For the difference of latitude, it will be,

As radius —— —— = 90d. com. —— = 10.0000000
To *d h*, the diſtance ſailed —— = 120 — = 2.0791812
So is the co-ſine of the courſe — = 53d.07m. = 9.7782870

To *de*, the difference of latitude = 72 — = 1.8574682

Caſe VI. One latitude, courſe, and departure being given, to find the other latitude and diſtance ſailed.

Example. Suppoſe a ſhip, in the latitude of 3 deg. 10 min. ſouth, ſails N. W. by N. till her departure be 90 miles, required her direct diſtance, and the latitude ſhe is in?

Geometrically. Let *k* (plate CX. *fig.* 12.) be the firſt place of the ſhip; draw the meridian *k l*, and the rhumb-line *k m*, forming an angle with the meridian = 33 deg. 45 min. the courſe ſteered; at the diſtance of 90 miles, the departure, draw the line *n o*, parallel to *k l*, then will *m* be the place the ſhip is arrived at; from the point *m*, let fall the perpendicular *m l*; then will *k m* be the diſtance, and *k l* the difference of latitude, both which may be meaſured, by applying them to the graduated lines on the chart.

Arithmetically. 1. To find the diſtance ſailed, it will be,

As the ſine of the courſe, or angle *k* = 33d. 45m. = —— —— —— —— } 9.7447390
To the departure *l m* —— — — = 90 — = 1.9542425
So is radius — —— —— = 90d. 00m. = 10.0000000

To the diſtance *k m* —— —— = 162 — = 2.2095035

Mercator's SAILING, the method of performing the ſeveral caſes of ſailing according to Mercator's projection.

Under the article MERCATOR's *Chart*, we have ſhewn the nature of this projection, with the method of conſtructing a table of meridional parts, to which we refer the reader; and ſhall proceed to ſhew the method of ſolving the ſeveral caſes of Mercator's ſailing.

Caſe I. The latitudes and longitudes of two places being given, to find the courſe and diſtance between them.

Example. Required the direct courſe and diſtance between the Lizard in the latitude of 50 deg. 00 min. north, longitude 5 deg. 14. min. weſt, and a port in the latitude of 32 deg. 20. min. north, and longitude 17 deg. 30 min. weſt?

Geometrically. 1. Draw the meridian *b k d* (plate CX. *fig.* 13.) and from *b* the Lizard, ſet off the meridional difference of latitude to *d*; through *d* draw the parallel *c d*, ſetting off on it the difference of longitude from *d* to *c*, and draw the line *b c*; then will *c* repreſent the given port.

2. Make *b k* equal to the proper difference of latitude, and draw *k l* parallel to *d c*. Then will the angle *c b d* be the direct courſe, *b l* the diſtance, and *k l* the departure, which may be meaſured, the courſe by the line of chords, and the diſtance *b l* by the ſcale of equal parts.

As all the caſes of Mercator's Sailing are projected after the ſame manner, we ſhall, for the ſake of brevity, omit it in the following caſes:

Arithmetically. As *b d*, the meridional difference of latitude — 1422,5 —— —— } 3,1530523
Is to radius —— — —— 90d. 00m. —— 10,0000000
So is *d c*, the difference of longitude — 736 — 2,8671728

To the tangent of the angle *c b d*, the direct courſe = 27d. 22 min. —— —— — } 9,7141205

Which is ſouth 27 deg. 22 min. weſterly, or nearly ſouth-ſouth-weſt a quarter weſterly, becauſe the port lies to the weſtward of the Lizard.

Then, to find *b l* the diſtance, it will be,

As radius —— —— —— 90d. 00m. 10,0000000
To *b k*, the proper diff. of latitude 1060 3,0253059
So is the ſec. of the ang. *l b k*, the cour. 27° 22′ 10,0515465

To *b l*, the direct diſtance —— 1193,6 —— 3,0768524

Caſe II. One latitude, courſe, and diſtance ſailed being given, to find the other latitude and difference of longitude.

Example. A ſhip in the latitude of 40 deg. 00 min. north, longitude 20 deg. weſt, ſails ſouth 51 deg. 10 min. weſterly, 1020 miles; required the latitude ſhe is in, and her difference of longitude?

1. As radius —— —— 90d. 00m. — 10,0000000
To the diſtance ſailed —— —— 1020 — 3,0086002
So is the co-ſine of the courſe — 51d. 10m. — 9.7973071

To the proper difference of latitude 640 —— 2,8059073

Hence the ſhip will be in the latitude of 29 deg. 20 min. north; whence the meridional difference will be = 780,3. Then it will be,

As radius —— —— —— 90d. 00m. — 10 0000000
To the meridional diff. of latitude — 780,3 — 2,8922616
So is the tangent of the courſe — 51d. 10m. — 10,0942155

To the difference of longitude — 970 —— 2,9864771

Caſe III. Both latitudes and courſe being given, to find the diſtance ſailed, and difference of longitude.

Example. A ſhip, in the latitude of 40 deg. 00 min. north, ſails ſouth 51 deg. 10 min. weſterly, till ſhe be found by obſervation to be in the latitude of 29 deg. 20 min.

min. north; required the direct diſtance ſailed and difference of longitude?

As radius —— —— —— —— 90d. 00m. — 10,0000000
To the proper difference of latitude 640 —— 2.8059073
So is the ſecant of the courſe — 51d. 20m. — 10,2026929

To the direct diſtance —— —— 1020 — 3,0086002

Then, having found the meridional difference of latitude = 780,3, it will be,

As radius —— —— —— 90d. 00m. — 10,0000000
To the meridional diff. of latitude — 780,3 — 2,8922616
So is the tangent of the courſe — 51d. 10m. — 10,0942155

To the difference of longitude —— 970 — 2,9864771

Caſe IV. Both latitudes and diſtance ſailed being given, to find the courſe ſteered and difference of longitude.

Example. A ſhip, in the latitude of 40 deg. 00 min. north, ſails between the ſouth and weſt 1020 miles, and is then found by obſervation to be in the latitude of 29 deg. 20 min. north; required the courſe ſteered, and difference of longitude?

As the diſtance ſailed —— — —— 1020 — 3,0086002
Is to radius —— —— — —— 90d. 00m. — 10,0000000
So is the proper difference of latitude — 640 — 2,8059073

To the co-ſine of the courſe — 51d. 10m. — 9,7973071

Whence the meridional difference of latitude will be = 780,3, and the difference of longitude found by the following proportion:

As radius —— —— —— — 90d. 00m. — 10,0000000
To the merid. difference of latitude — 780,3 — 2,8922616
So is the tangent of the courſe — 51d. 10m. — 10,0942155

To the difference of longitude —— 970 — 2,9864771

Caſe V. One latitude, courſe, and difference of longitude being given, to find the other latitude and diſtance ſailed.

Example. Suppoſe a ſhip, in the latitude of 40 deg. 00 min. north, ſails ſouth 51 deg. 10 min. weſterly, until her difference of longitude be 970 miles; required the diſtance ſailed, and what latitude ſhe is in?

As the tangent of the courſe — 51d. 10m. — 10,0942155
To the difference of longitude — 970 —— 2,9864771
So is radius —— —— — 90d. 00m. —— 10,0000000

To the meridional difference of lat. 780,3 — 2,8922616

And, becauſe the ſhip is ſailing towards the equator, therefore,

From the merid. parts of the lat. ſailed from 40d. 00m. —— —— —— —— —— —— } 2622,7
Take the meridional difference of latitude —— 780,3

Remain the mer. parts of the lat. arrived in 29° 20′ 1842,4

Whence the proper difference of latitude will be 640.

Then, to find the diſtance ſailed, it will be,

As radius —— —— —— 90d. 00m. — 10,0000000
To the proper diff. of latitude —— 640 — 2,8059073
So is the ſecant of the courſe — 51d. 10m. — 10,2026989

To the diſtance ſailed —— —— 1020 —— 3,0086062

And becauſe the ſhip is ſailing towards the equator, and, conſequently, decreaſing the latitude; therefore,

	d.	m.
From the latitude ſailed from ——	40	00 north
Take the difference of latitude — 640 =	10	40
Remains the latitude ſhe is in ——	29	20 north

Caſe VI. One latitude, courſe, and departure being given, to find the other latitude, diſtance, and difference of longitude.

Example. Suppoſe a ſhip in the latitude 40d. 00m. north, longitude 20d. 00m. weſt, ſails ſouth 51d. 10m. weſterly till ſhe have departed from her former meridian 794,6 miles; required the diſtance ſailed, difference of longitude, and what latitude ſhe is in?

1. As the ſine of the courſe — 51d. 10m. — 9,8915226
To the departure —— — —— 94,6 — 2,9001486
So is radius —— —— 90d. 00m. — 10,0000000

To the diſtance —— —— —— 1020 —— 3,0086260

2. As the tangent courſe — 51d. 10m. — 10,0942155
To the departure —— —— 794,6 — —— 2,9001486
So is radius —— —— 90d. 00m. — 10,0000000

To the proper difference of lat. —— 640 — 2,8059331

And, as the ſhip is conſtantly decreaſing her latitude, therefore the difference of latitude, being taken from the latitude ſailed from, will give 29 deg. 20 min. north, the latitude the ſhip is in; whence the meridional difference of latitude will be 780,3.

Then, to find the difference of longitude, it will be,

As radius —— —— —— 90d. 00m. —— 10,0000000
To the meridional diff. of lat. —— 780,3 — 2,8922616
So is the tangent of the courſe — 51d. 10m. — 10,0942155

To the diff. of long. —— —— 970 —— 2,9864771

Caſe VII. The departure and both latitudes being given, to find the courſe, diſtance, and difference of longitude.

Example. Suppoſe a ſhip in the latitude of 40 deg. 00 min. north, 20 deg. 00 min. weſt longitude, ſails between the ſouth and weſt till ſhe be found by obſervation to be in the latitude of 29 deg. 20 min. north, and to have departed from her former meridian 794,6 miles; the courſe ſteered, diſtance ſailed, and difference of longitude are required?

1. As the proper difference of latitude 640 2,8059073
To radius —— —— 90d. 00m. —— 10,0000000
So is the departure —— 794,6 —— 2,9001486

To the tangent of the courſe 51d. 10m. — 10,0942413

2. As the ſine of the courſe 51d. 10m. 9,8915226
To the departure —— —— 794,6 —— 2,9001486
So is radius —— —— —— 90d. 00m. — 10,0000000

To the diſtance —— —— 1020 — 3,0086260

Then, having found the meridional difference of latitude, the difference of longitude will be found by the following proportion:

As radius —— —— 90d. 00m. — 10,0000000
To the merid. diff. of latitude — 780,3 — 2,8922616
So is the tangent of the courſe 51d. 10m. 10,0942155

To the difference of longitude — 970 — 2,9864771

Or it may be found by the log. tangents, thus,

As the tang. of the log. rumb. 51d. 30m. 19ſ. 10,1015093
To the log. of the remainder —— 985,825 — 2,9937899
So is the tang. of the courſe 51d. 10m. — 10,0942155

To the difference of longitude —— 970 — 2,9864961

Caſe VIII. One latitude, diſtance ſailed, and departure being given, to find the other latitude, courſe, and difference of longitude.

Example. A ſhip in the latitude of 40 deg. 00 min. north, longitude 20 deg. 00 min. weſt, ſails between the ſouth and weſt 1020 miles, and is found to have departed from her former meridian 794,6 miles; required the courſe ſteered, difference of longitude, and what latitude ſhe is in?

1. As the diſtance —— —— 1020 —— 3,0086002
To radius —— —— —— 90d. 00m. —— 10,0000000
So is the departure —— —— 794,6 —— 9,9001486

To the ſine of the courſe — 51d. 10m. — 9,8915484
2. As radius —— —— 90d. 00m. — 10,000000
To the diſtance —— —— 1020 —— —— 3,0086002
So is the co-ſine of the courſe — 51d. 10m. — 9,7973071

To the proper difference of lat. — 640 — 2,8059073

Hence it appears, that the ſhip's true courſe is ſouth 51 deg. 10 min. weſterly, or nearly ſouth-weſt half weſterly, and that ſhe is in the latitude of 29 deg. 20 min. north; whence the meridional difference of latitude is 780,3; and to find the difference of longitude, it will be,

As radius —— —— 90d. 00m. — 10,0000000
To the merid. differ. of latitude — 780,3 — 2,8922616
So is the tang. of the courſe —51d. 10m.— 10,0942155

To the difference of longitude — 970 — 2,9864771

Middle Latitude SAILING, a method of performing the problems of ſailing by the help of the middle latitude, which nearly agrees with Mercator.

Current SAILING. See CURRENT.

Parallel SAILING, the method of finding the diſtance run, when a ſhip ſails under a parallel, or on a direct eaſt or weſt courſe.

Under the article DEGREE, we have ſhewn the method of finding the length of a degree of longitude in any latitude, and given a table for that purpoſe; by the help of which, all the propoſitions relating to parallel ſailing may be eaſily ſolved.

SAILS, in navigation, are large cloths of canvas, formed by a combination of ſmall ones, whoſe edges are ſewed together by double ſeams, and whoſe ſkirts are ſurrounded by a rope called the bolt-rope. They are extended on or between the maſts, to catch the wind, whereby the ſhip is impelled along the ſurface of the water. See MAST, YARD, and BOLT-ROPE.

There is a great variety of ſails in every ſhip, as ſuited to the force or direction of the wind. The principal ones are the courſes and top-ſails, which are ſpread by the lower and the top-ſail yards. See COURSE and TOP-SAIL.

The ſails on the main-maſt are the main-ſail, which is the loweſt and largeſt, next the top-ſail, and above it the top-gallant-ſail. On the fore-maſt, in the ſame poſition, the fore-ſail, the fore-top-ſail, and fore-top-gallant-ſail; and on the mizen-maſt, the mizen, the mizen-top-ſail, and mizen-top-gallant-ſail. Above the main and fore-top-ſails there is frequently a ſmall light ſail, hoiſted in fair weather and light winds, called the royal; and without the ſkirts of the main-ſail, fore-ſail, main and fore-top-ſails, there are alſo thin ſails, extended in fair winds, called the ſtudding-ſails. See the article STUDDING-*Sail.*

The ſails ſpread between the maſts are moſt uſually triangular; theſe are termed ſtay-ſails, being hoiſted upon the ſtays, which deſcend obliquely from the maſt-heads.

The ſails upon the bow-ſprit are the jib, fore-ſtay-ſail, ſprit-ſail, and ſprit-ſail-top-ſail.

Beſides theſe there are many others which are ſet occaſionally, as the driver, ring-tail, water-ſail, croſs-jack, &c. &c.

The ſtay-ſails, between the mizen and main-maſts, are denominated the mizen-ſtay-ſail, mizen-top-maſt-ſtay-ſail, and mizen-top-gallant-ſtay-ſail.

Thoſe between the main and fore-maſts are termed the main-ſtay-ſail, main-top-maſt-ſtay-ſail, middle-ſtay-ſail, and main-top-gallant-ſtay-ſail.

The ſtay-ſails before the fore-maſt are already deſcribed, as being on the bow-ſprit, to be the jib and fore-ſtay-ſail; there is alſo ſometimes a fore-top-maſt-ſtay-ſail, or inner jib.

There are ſeveral different methods of ſailing, as quartering, large, afore the wind, and cloſe hauled. See QUARTERING, &c.

The motion of ſailing communicated to the ſhip is thus elegantly deſcribed by the ingenious M. Bouguer.

When a ſhip ſails out of a harbour, ſhe acquires her motion by infinitely ſlow degrees, much after the ſame manner as heavy bodies, in their fall, arrive not at a certain velocity, but by an infinite repetition of the action of their weight.

The firſt impulſions of the wind greatly affect the velocity, becauſe the reſiſtance of the water might deſtroy them; for the velocity being at firſt ſmall, the reſiſtance of the water, which depends thereon, will be very weak; but the faſter the ſhip goes, the leſs will be the force of the wind on the ſails; whereas it is quite otherwiſe with reſpect to the impulſion of the water on the bow, becauſe it augments in proportion to the velocity with which the ſhip ſails. So the new degrees which the effort of the ſails adds to the motion of the ſhip, are continually decreaſing; whilſt, on the contrary, thoſe which

diminiſh the reſiſtance of the bow are continually encreaſing. The velocity is accelerated in proportion as the quantity added is greater than that ſubſtracted; but, when theſe two powers become equal, when the impulſion of the wind on the ſails has loſt ſo much of its force as not to act, but in proportion to the force with which the reſiſtance of the water acts on the bow, in the oppoſite ſenſe, the ſhip will then go no faſter, and will ſail with a conſtant uniform motion. The great weight of the ſhip may be the cauſe of the ſhip's being ſo long in coming to her greateſt velocity; but this weight makes nothing to the degree of velocity; and when the ſhip has once come to it, ſhe afterwards goes on by her own intrinſic motion, and ſhe can neither gain nor loſe any new degree of velocity. She moves as by her own proper force in vacuo, without being afterwards ſubject either to the effort of the wind on the ſails, or the reſiſtence of water on the bow. If at any time the impulſion of the water on the bow ſhould deſtroy any part of the velocity, the impulſion of the wind on the ſails will repair it, ſo the motion will continue the ſame; but it muſt be obſerved, this will only be when theſe two powers act in a direction quite contrary to one another: otherwiſe they will not mutually deſtroy one another. The whole theory of working ſhips depends upon this oppoſition and perfect equality which ſhould ſubſiſt between the impulſion of the water and the impulſion of the wind. *Traité du Navire.*

With regard to the ſailing order of a fleet, ſee the article SQUADRON.

SAINT, in the Romiſh church, a holy perſon deceaſed, and ſince his deceaſe canonized by the pope, after ſeveral informations and ceremonies.

SAINTFOIN, *Onobrychis*, in botany, &c. an artificial paſture much uſed for the feeding of cattle.

The roots of ſaintfoin are long, woody, black without and white within. They are perennial, and terminate at the ſurface of the ground in a head, whence riſe the leaves and ſeveral ſtalks, two feet or two and a half long, of a reddiſh colour, and bending on all ſides. The leaves of ſaintfoin are conjugated, and conſiſt of ſeveral ſmall leaves or folioles, green above, and white and velvety beneath: they terminate in a point, and are faſtened by pairs to a common foot-ſtalk, which terminates in a ſingle ſmall leaf or foliole. The branches are terminated by ſpikes of leguminous red flowers, and ſometimes white. When the bloom is paſt, the piſtil becomes a ſmall creſted pod, rough, and containing a ſeed like a kidney.

There is another ſort of ſaintfoin that is ſmaller, and the ſeeds rougher: the large ſort is beſt. There is alſo another large ſort that comes from Spain, which has very red flowers: this yields a great deal of graſs; but hard froſts kill it.

Saintfoin is a very vigorous plant, and yields a great deal of excellent fodder; not ſo much however as lucerne, becauſe it can only be mowed twice a year; but it has the advantage of lucerne in not being ſo nice with reſpect to the ſoil: it thrives infinitely better in well-manured land, that has a good depth of ſoil; but it does not do amiſs in ruſſet lands, in which lucerne would ſoon periſh: beſides, every kind of grain grows well on land that has been in ſaintfoin.

Land intended for ſaintfoin has two or three ploughings, that it may be well broke: the ſtones muſt be picked off the land, that it may be mowed cloſe. About two thirds of the uſual quantity of oats ſhould be ſowed with the ſaintfoin; and, for an arpent of an hundred perches, each twenty-two feet, eight buſhels, Paris meaſure, of ſeed ſhould be uſed. The ſaintfoin mixed with the oats ſhould be ſowed in March, and covered with the harrow, as it would not grow if buried too deep. As ſaintfoin ſeed is often bad, a little of it ſhould be kept out of the field; and the ſecond year the firſt crop is cut, which however is not ſo good as that of the third.

Saintfoin is cut ſooner or later according to the uſe it is to be put to. If it is for ſheep, it ſhould be mowed as ſoon as it is in bloom; if to feed oxen or cows, when the bloom is over; and if for horſes, it ſhould be ſuffered to ſtand till the ſeed is partly formed in it, in which ſtate the horſes are very fond of it: finally, if it is intended to ſave the ſeed, either for ſowing, or to give to horſes,

which like it better than oats, or to feed poultry, the ſaintfoin ſhould not be cut till the greateſt part of the ſeed is ripe. When the ſeed of ſaintfoin is to be ſaved, it ſhould be mowed early in the morning, before the dew is off, or there will be a loſs.

Saintfoin of three or four years old is generally cut when the bloom is going off. In the ſouthern provinces they keep the cattle out of it, when they would have a ſecond or third crop: but in the other parts of the kingdom, inſtead of taking a ſecond crop, they turn their horned cattle into it, and the rather, becauſe after the firſt crop of ſaintfoin, ſeed becomes ſcarce elſewhere.

Saintfoin has another advantage over lucerne, it being much eaſier mowed, becauſe the ſap, being leſs viſcous, evaporates ſooner; and it is of a greener colour when in a dark ſeaſon it is dried by the wind. If rain falls after ſaintfoin is cut, the ſwarths muſt not be turned till the weather is fine: by this means it will ſtill be green and good. There is another advantage in ſaintfoin, which is, that though the weather ſhould prove rainy, it may be mowed either before the bloom, whilſt it is in bloom, when the bloom is paſt, or when the ſeed is ripe, as it is moſt likely that at ſome of thoſe periods the weather will prove fine.

It may be imagined, that ſaintfoin which has perfected its ſeeds will yield but indifferent fodder: the leaves and flowers being fallen, nothing remains but large ſtalks, which however horſes will eat, the taſte being agreeable to them.

Saintfoin when in good order yields a fodder excellent for all kinds of cattle, as has been already noticed, whether it is given green or dry: care however muſt be taken that they do not eat too much of it, particularly ſuch as do not much work; for inſtance, moſt coach-horſes.

Though this plant will grow in all ſorts of land, except ſuch as is marſhy, yet it thrives much beſt in a good ſoil: it would therefore be of uſe to dung it now and then. The vigor of the plants may be increaſed by allowing the roots a ſpace of ſoil to extend in, and giving it frequent tillage: for this reaſon, when we would preſerve it for more than nine years, it ſhould be cultivated in rows, in the manner of lucerne; with this difference however, that there may be two rows of ſaintfoin; and two ſtirrings to the intervals will be enough. But as ſaintfoin will thrive in any ſoil, and prepares land well for wheat or rye, it is ſeldom preſerved long in the ſame field; therefore the common method of huſbandry is in general beſt for it. It is proper to obſerve, that two buſhels of ſaintfoin ſeed will do horſes as much good as three of oats.

Saintfoin ſeed will keep very well when it is put into the barn unthraſhed; but when it is thraſhed, it muſt be ſpread thin in the granary, and often turned, or it will be in danger of heating.

The uſe of this fodder is not ſo dangerous to horſes as lucerne, or even clover. *Du Hamel's Huſbandry.*

SAKER, a ſmall ſort of cannon, of which there are three ſpecies, extraordinary, ordinary, and middle ſized.

SALAMANDER, *Salamandra*, in zoology, a name given by authors to ſeveral ſpecies of the lizard kind; but the principal are two, the ſalamandra aquatica, the water-newt, and the ſalamandra terreſtris.

The ſalamandra aquatica is the two-edged-tail lizard, with four toes on the anterior, and five on the hinder, feet. It grows to about four inches in length, and to the thickneſs of a man's finger: the back is of a deep ſhining brown; the belly of a bright and gloſſy yellow.

The ſalamandra terreſtris, or land ſalamander, is a ſpecies of lizard, the tail of which is ſhort, and its colour of a fine black, marked with red ſpots of a bright and ſhining gloſſy appearance.

SALAMANDER'S-BLOOD, among chemiſts, denotes the redneſs remaining in the receiver after diſtilling the ſpirit of nitre.

SALARY, *Salarium*, a recompence made to a perſon for his pains or induſtry about another perſon's buſineſs, as in the caſe of officers, &c.

SALE, in general, ſignifies the transferring the property of goods from one to another, upon ſome valuable conſideration, as where in a bargain one agrees to give another a certain ſum of money for ſuch goods, and thereupon gives the ſeller earneſt, which he accepts; this is a perfect ſale, and ſhall bind the buyer and ſeller.

SALEP, in the materia medica, the root of a ſpecies of orchis. See ORCHIS.

This plant, which has ſix or ſeven long ſmooth narrow leaves, is variegated with dark coloured ſtreaks or ſpots, iſſuing from the root; and one or two embracing the ſtalk, which is ſingle, roundiſh, and ſtriated: on its top appears a long looſe ſpike of irregular, naked, purpliſh red flowers, conſiſting each of ſix petala; one of which is large, cut into three ſections, hanging downwards; the others ſmaller, forming a kind of hood above it, with a tail behind: the root conſiſts of two roundiſh whitiſh tubercles, about the ſize of nutmegs, one plump and juicy, the other fungous and ſomewhat ſhrivelled, with a few large fibres at top. It is perennial, grows wild in ſhady grounds and moiſt meadows, and flowers in the beginning of May or ſooner.

The plump roots or bulbs, the only part directed for medicinal uſe, have a faint ſomewhat unpleaſant ſmell, and a viſcid ſweetiſh taſte. They abound with a glutinous ſlimy juice, in virtue of which they have been found ſerviceable, like althea root and other mucilaginous vegetables, in a thin acrid ſtate of the humours and eroſions of the inteſtines. They have been celebrated alſo for analeptic and aphrodiſiac virtues, to which they appear to have little claim.

The ſubſtance brought from the Eaſtern countries under the names of ſalep, ſalleb, and ſerapias, and recommended, like our orchis root, in bilious dyſenteries, defluxions on the breaſt, and as a reſtorative, appears to be no other than the prepared roots of ſome plants of the orchis kind, of which different ſpecies are ſaid to be taken indiſcriminately. The ſalep comes over in oval pieces, of a yellowiſh white colour, ſomewhat clear and pellucid, very hard and almoſt horny, of little or no ſmell, in taſte like gum tragacanth. The common orchis root, boiled in water, freed from the ſkin, and afterwards ſuſpended in the air to dry, gains exactly the ſame appearance: the roots thus prepared do not grow moiſt or mouldy in wet weather, which thoſe that have been barely dried, are very liable to do: reduced into powder, they ſoften or diſſolve as it were in boiling water into a kind of mucilage; which may be diluted, for uſe, with a large quantity of water, or with milk.

SALIANT, in fortification, denotes projecting. There are two kinds of angles, the one ſaliant, which are thoſe that preſent their points outwards; the other re-entering, which have their points inwards.

SALIENT, SALIANT, or SAILLANT, in heraldry, is applied to a lion, or other beaſt, when its fore-legs are raiſed in a leaping poſture.

SALIC, or SALIQUE-LAW, *Lex Salica*, an ancient and fundamental law of the kingdom of France, uſually ſuppoſed to have been made by Pharamond, or at leaſt by Clovis, in virtue whereof males are only to inherit. Du Haillan, after a critical examination, declares it to have been an expedient of Philip the Long, in 1316, for the excluſion of the daughter of Lewis Hutin from inheriting the crown. Father Daniel, on the other hand, maintains that it is quoted by authors more ancient than Philip the Long, and that Clovis is the real author of it. This law has not any particular regard to the crown of France; it only imports, in general, that in Salic land no part of the inheritance ſhall fall to any female, but the whole to the male ſex. By Salic lands, or inheritances, were anciently denoted, among us, all lands, by whatever tenure held, whether noble or baſe, from the ſucceſſion whereto women were excluded by the Salic law; for they were by it admitted to inherit nothing but moveables and purchaſes, wherever there were any males.

SALII, in Roman antiquity, prieſts of Mars, of which there were twelve, inſtituted by Numa, wearing painted parti-coloured garments and high bonnets, with a ſteel cuiraſs on the breaſt. They were called Salii from *ſaltare*, to dance; becauſe, after aſſiſting at ſacrifices, they went dancing about the ſtreets, with bucklers in the left hand, and a rod in the right, ſtriking

musically on one another's bucklers with their rods, and singing hymns in honour of the gods.

SALIVA, *Spittle*, a thin pellucid humour, separated from the arterial blood, by the glands about the mouth and fauces, and conveyed, by proper salival ducts, into the mouth, for several uses.

It consists of a great deal of water or phlegm, and a volatile salt, and some add a sulphureous spirit; and is void both of taste and smell: its uses are very great; it moistens the throat, preserves it from the injuries of the air, and facilitates speech. Being mixed with aliment, it renders swallowing easy, and assists digestion by its aqueous, saline, and oily parts. Some imagine it to do the office of a menstruum, by mixing the oily and aqueous parts of the food more intimately, dissolving the saline parts, and procuring a fermentation in the stomach: but Dr. Drake is of opinion, that were the saliva acrimonious enough for this purpose, it must greatly offend the stomach, especially considering the quantities of it that many swallow, even upon an empty stomach. In hungry persons, says Boerhaave, it is fluid, acrid, and copiously discharged; and in those who have fasted long, it is highly acrid, penetrating, and resolvent. In farinaceous and succulent vegetables, it not only produces a fermentation, but also augments one already begun. It is swallowed not only by brutes, but by human creatures, in a sound state, even when asleep. Too copious an evacuation of it, made voluntarily, produces loss of appetite, bad digestion, and an atrophy. By manducation therefore the saliva is expressed and accurately mixed with the attenuated food; which contributes, first, to the assimilation of the aliments to the nature of the body to be nourished: secondly, to the due mixture of the oleous to the aqueous parts: thirdly, to the solution of the saline parts: fourthly, to fermentation: fifthly, to a change of the taste and smell of the aliments: sixthly, to an augmentation of the intestine motion: seventhly, to a momentaneous relief from hunger; and, eighthly, an application of the sapid parts, though insipid itself. See CHYLIFICATION, MANDUCATION, DIGESTION, &c.

SALIVAL, an epithet applied to the glands and ducts which supply and secrete the saliva.

SALIVATION, in medicine, a promoting of the flux of saliva, by means of medicines, mostly by mercury. The chief use of salivation is in diseases belonging to the glands, and the membrana adiposa, and principally in the cure of the venereal disease, though it is sometimes also used in epidemic diseases, cutaneous diseases, &c. whose crises tend that way. See the articles Pox, &c.

A salivation is excited, according to Boerhaave, 1. By washing the mouth with certain liquors. 2. By the slow and protracted mastication of some viscid matter, such as mastich, wax, and myrrh, especially if acrid substances are mixed with these, such as pellitory of Spain, pyrethrum, ginger, and pepper. 3. By drawing into the mouth acrid and irritating vapours, such as those of tobacco, sage, rosemary, marjoram, thyme, and mother of thyme. 4. A salivation is excellently excited by the action of such medicines as produce a gentle but long continued nausea, such as antimony neither entirely fixed nor totally emetic, taken with a small quantity of common vitriol. 5. By such substances as totally dissolve all the parts of the blood, convert it into lymph, and render it fit for a discharge by way of saliva; such as crude quicksilver, cinnabar, a solution of quicksilver in aqua fortis, white precipitate, red precipitate, turbith mineral, and sublimate mercury dissolved: the action of those medicines is promoted by warm fomentations applied to the head, neck, and face. An excessive salivation is lessened or stopped, 1. By a large and continual use of mild and tepid drinks, such as decoctions of mallows and liquorice in milk and water. 2. By allaying the impetus of the humours, by means of mild, oleous, and anodyne emulsions, with a proper addition of diacodium or opium. And, 3. By making a revulsion of the humours to other parts, especially that by stool. But great caution is necessary, lest the impetus of the moved matter, which in this case is always acrid, should rush to other parts, and produce a greater danger.

The regular, safest, and most commodious method of salivation is by mercurius dulcis six times sublimed, given inwardly in the milder pox, &c. or by mercurial unction, when the disease is got into the bones. According to Turner, fifteen grains of mercurius dulcis may be given in a morning, and a like dose at night, with electuary of scordium. After three, four, or five days, with this management, the fauces are observed to inflame, the inside of the cheeks to tumify, the tongue to look white and foul, the gums to stand out, the breath to stink, and the whole inside of the mouth to appear shining and lie in furrows as if parboiled. The patient now refuses nourishment, while all parts of his chaps are so swelled and sore that he cannot chew any solid food, but is forced to take liquids and the softer aliments. They are now frequently sick, and throw up a thin phlegm. The inside of the mouth thus beginning to be wealed, will soon be ulcerated, especially about the salival glands, which empty themselves thereinto. Now it may be proper to desist a day or two, to observe the increase of the ulcers, what sloughs are like to be raised, and what their depth and dimensions are like to prove, from which a near conjecture may be made of the duration as well as quantity of the spitting now begun, and the consistence of the drilling lympha. The salivation thus begun, the patient is to be sometimes refreshed by a little mulled wine. Let his diet be small chicken broth, water-gruel, and panada; his drink small sack-whey, or posset-drink, and a draught of good small beer, with a toast, between whiles; and in case of gripes or a looseness, the white decoction.

Thus, after some days respite, if the patient is hearty, his chaps but little swelled on the outside, and as little sore within, the ulcers not increasing, and the flux inconsiderable, you may give one scruple of mercurius dulcis in electuary of scordium at going to rest, repeating it two or three days following, as you find occasion; or you may vomit him with eight or ten grains of turpeth mineral, in conserve of roses: but if the salivation cannot be raised to any quantity, you must forbear, and purge it off, and give calomel once or twice a week, and purge it off the next day, or two days after. When the spitting goes well forward, it may be left to take its course, till it declines of itself, which in proportion to the ulcers and thickness of the sloughs about the mouth, may happen at the end of twenty-one days, or a month from its first rising; that is, from the time of spitting a pint and a half a day, till it come to three pints or even five pints in twenty-four hours, then it gradually goes off again.

In the more stubborn and rebellious pox, &c. attended with grievous symptoms, such as rotten bones, &c. and the patient has been used to mercurials, or salivated before, then the cure must be attempted with salivation by unction. To this end mix an ounce of quicksilver with three ounces of axungia, of which an eighth part is to be used night and morning, letting the patient rub it with his own hands gently by the fire, beginning with his ancles, up to his shins and knees, all round his joints, and so to his thighs, which are presently after to be covered with yarn-stockings and flannel-drawers; then let him use the remainder of his eighth part about his elbows and shoulders, wiping his hands clean about the glands of his arm-pits, or those of his groin: his body, during the unction, should be screened from the cold with a blanket hung behind him, and then be wrapped up in warm flannel, that is, a flannel shirt, waistcoat, drawers, cap, and muffler. And the same is requisite in the former way, to defend the patient from the cold air. The weak need only to anoint once a day; but those that are strong, may take a fourth part of the ointment, and rub it in at once every night; after which let him get between flannel-sheets or blankets, disposing him to a gentle breathing sweat with a draught of warm posset, mace-ale, or, if very feeble, with a cup of mulled wine. If, when the ointment is divided into four parts, after the third unction, the patient begins to complain of his chaps, you may stay a day or two before you proceed farther; the same when gripes or bloody stools approach. On the other hand, if an ounce or an ounce and

and a half of quickſilver will not do, give the turpeth, as before directed: and if the ſpitting declines too ſuddenly, give a ſcruple of calomel every day, for two or three times, as you ſee occaſion. When the ſalivation is going off, the patient may be purged with two or three ounces of the common infuſion of ſena, and one ounce of the ſyrup of buckthorn.

To prevent the jaws from being locked up, it is neceſſary to uſe a bit of ſtick, covered with a ſoft rag, to be held between his backward teeth; and if there ſhould happen an adheſion of the inſide of the cheek to the gum, the ſame is to be carefully divided. If, during the ſalivation, a blood-veſſel burſt open, it is to be cloſed up with a little pellet, covered with powder of alum or vitriol, and dipped in the tinctura ſtyptica: if it happens from the ſeparation of ſloughs from the ſides of the cheeks, a little oxycrate held in the mouth will do the buſineſs. If the patient has been without a ſtool for ſome time, give him an emollient clyſter of warm milk, ſugar, and oil: and if the fauces ſhould ſuddenly tumify, ſo as to endanger a ſuffocation, the moſt certain relief is to bring the humours downwards by ſharp clyſters and cathartics.

The patient ſhould be prepared for a ſalivation by a lenitive purge or two; and if plethoric, he ſhould bleed: likewiſe bathing in warm water, for ſome hot, lean, emaciated people, has been found of ſervice. Women ſhould be laid down juſt after their menſtrual flux is over. Temperate weather is the moſt ſuitable.

SALIX, the willow, in botany, a genus of plants, the leaves of which are entire; the flower, which is male, and grows on a ſeparate plant, is amentaceous, ſpiked, and conſiſts of a multitude of ſtamina. The ovary, which is found only on the female plant, is furniſhed with a long tube, adorned with four horns, is of a conoidal figure, and conſtituted in ſuch a manner as to become a ſpiked fruit, containing a multitude of capſules reſembling horns, and gaping by maturity into two parts. Theſe capſules are full of many downy ſeeds.

There are a great number of ſpecies to be found in England, eſpecially of the ſallows; as I have been informed by a very judicious baſket-maker, there are at leaſt thirty ſorts, which they diſtinguiſh by name, commonly in uſe in their trade; and, beſides theſe, there are a great number of mountain willows, which grow upon dry grounds, and are cultivated as underwood, in many parts of England.

All the ſorts of willows may be eaſily propagated by planting cuttings or ſets in the ſpring, which readily take root, and are of quick growth. Thoſe ſorts which grow to be large trees, and are cultivated for their timber, are generally planted from ſets, which are about ſeven or eight feet long: theſe are ſharpened at their larger end, and thruſt into the ground by the ſides of ditches and banks, where the ground is moiſt; in which places they make a conſiderable progreſs, and are a great improvement to ſuch eſtates; becauſe their tops will be fit to lop every fourth or fifth year. The larger wood, if ſound, is commonly ſold for making wooden heels, and pegs for ſhoes; as alſo to the turners, for many kinds of light wares.

The ſallows are commonly planted in cuttings made from ſtrong ſhoots of the former year, and are about three feet long; theſe are commonly thruſt down two feet deep into the ground, and are one foot above it. The ſoil ſhould always be dug or plowed before they are planted, and the cuttings placed about three feet row from row, and eighteen inches aſunder in the rows; obſerving always to place the rows the ſloping way of the ground, eſpecially if the tides overflow the place; becauſe, if the rows are placed the contrary ways, all the filth and weeds will be detained by the plants, which will choak them up.

The beſt ſeaſon for planting theſe cuttings is in February; for, if they are planted ſooner, they are apt to peel, if it proves hard froſt, which greatly injures them.

Theſe plants are always cut every year; and, if the ſoil be good, they will produce a great crop, ſo that the yearly produce of one acre has been often ſold for fifteen pounds; but ten pounds is a common price, which is much better than corn land; ſo that it is great pity theſe plants are not more cultivated, eſpecially upon moiſt boggy ſoils, upon which few other things will thrive.

SALLET, or SALLAD, a diſh of eatable herbs, ordinarily accompanying roaſt meat, compoſed chiefly of crude freſh herbage, ſeaſoned with ſalt, oil, and vinegar; ſome add muſtard, hard eggs and ſugar; others pepper; and others ſpices, with orange-peel, ſaffron, &c. The principal ſallet-herbs, and thoſe which ordinarily make the baſis of our ſallets, are lettice, celeri, endive, creſſes, raddiſh and rape; to which are ſometimes added purſlane, ſpinach, ſorrel, tarragon, burnet, corn-ſallet, and chervil.

SALLY, in archetecture, is what we more uſually call projecture. See PROJECTURE.

SALLY, in the military art, the iſſuing out of the beſieged from their town or fort, and falling upon the beſiegers in their works, hinder the progreſs of their approaches, deſtroy their works, &c.

SALMO, SALMON, in ichthyology, a well known fiſh. It is diſtinguiſhed from other fiſh of the truttaceous kind by theſe characters: it is of an oblong body covered with very ſmall ſcales, a ſmall head, a ſharp noſe, and a forked tail. Its back is bluiſh; the reſt of its body whitiſh, or reddiſh, and uſually ſpotted. Its under jaw is bent upwards, and that ſometimes ſo much as to make itſelf a ſinus in the upper, by conſtant motion, and ſometimes to perforate it.

The ſalmon is firſt produced from its parent's ſpawn in freſh rivers, thence it goes into the ſea to acquire its growth and feed, and, at the time of its full growth, and in the ſeaſon for ſpawning, it removes into the freſh waters again.

The ſalmon, in the different ſtages of its life and growth, has different names. The Latins call it, when young, ſalar, when of a middle growth ſario or fario, and only when full grown ſalmo. In England the fiſhermen have names for it in every year of its growth. In the firſt it is called a ſmelt, in the ſecond a ſprod, in the third year a mort, in the fourth a fork-tail, in the fifth a half-fiſh, finally, in the ſixth it is called a ſalmon. This is the common agreement of our fiſhermen, though there are ſome who ſay the ſalmon comes much ſooner to its full growth. *Willughby's Hiſt. Piſc.*

The ſalmon is bred in rivers, but goes every year from thence into the ſea; and at a certain ſeaſon of the year it always returns up into the freſh water again; and what is remarkable, is, that, ſo far as obſervation has been able to trace them at any time, the ſame ſhoals of ſalmon always return into the ſame river out of which they ſwam, not into any other; ſo that the people who live on the ſalmon fiſhery are not afraid for their rivers being cleared, by all the fiſh in them going down into the ſea, for they know that they will all return up to them again at a proper time. When the ſalmon has once entered a freſh river, he always ſwims up againſt the ſtream, and often will go an hundred leagues up a river in the large and long rivers; and the people at this vaſt diſtance from the mouth have the pleaſure of taking a fiſh, that is properly in part of the ſea kind. It is alſo remarkable, that the rivers which moſt abound with ſalmon do not make the ſeas about their mouths, any more abound with them than others, particularly the harbour of Breſt affords no ſalmon; though the river Chateaulin, which diſcharges itſelf into it, is the richeſt ſalmon river in France.

Another ſingularity, in regard to the ſalmon, is their ſwimming up the rivers together in ſuch vaſt numbers. It is to be allowed, indeed, that herrings, mackarel, and many other fiſh, do in the ſame manner appear on the coaſts at certain ſeaſons, in prodigious numbers; but the reaſons for their coming together, in theſe quantities, are much more eaſily explained than that of the ſalmon's doing ſo. The herrings, when they come in ſuch prodigious ſhoals to the coaſts of Normandy, have been found to be allured thither in theſe numbers by a prodigious quantity of a particular ſort of ſea worms, which are their favourite food, and which are found to cover the whole ſurface of the ſea at that time. Rondeletius has deſcribed theſe inſects under the name of ſea caterpillars; they always appear in the months of June, July, and Auguſt, which are the herring ſeaſons at that part of the

world; and probably the ſame cauſe will be found to bring them to other places, if ſufficiently enquired into, as theſe and ſome other fiſh come to certain places in ſhoals to get food. The ſalmon do it, in order to propagate their ſpecies. The ſpawn of the ſalmon is never depoſited but in rivers, and, at the time that theſe fiſh are found up the rivers, it is only with this intent; the females go firſt, and the males follow as far as the others pleaſe to lead them, which is uſually to ſome convenient place in ſhallow water, where the ſpawn, when depoſited, is not buried under too great a quantity of water, but has the advantage of a continual warmth from the ſun's heat.

Salmon do not equally frequent all rivers, though they may ſeem to us equally proper for their reception. There are two rivers which open themſelves into the harbour of Breſt, very near one another; the one of theſe is famous for the quantity of ſalmon in it, and the great advantage of the fiſhery; the other never has any of theſe fiſh in it. It moſt probably is owing to their finding plenty of food, and proper places for the depoſiting their ſpawn in the one of theſe rivers, and not in the other, that makes this regular choice. *Des Landes, Trait. Phyſ.*

SALON, or SALOON, in architecture, a very lofty ſpacious hall, vaulted at top, and ſometimes comprehending two ſtories or ranges of windows. The ſalon is a grand room in the middle of a building, or at the head of a gallery, &c. Its faces or ſides ought all to have a ſymmetry with each other; and as it uſually takes up the height of two ſtories, its cieling, as Daviler obſerves, ſhould be with a more moderate ſweep. Salons are frequently built ſquare, and ſometimes octogonal.

SALT, *Sal*, in natural hiſtory, the name of a ſeries or ſubdiviſion of foſſils, naturally and eſſentially ſimple, not inflammable, and ſoluble in water.

Dr. Shaw defines ſalt to be a ſubſtance that readily diſſolves in water, taſtes ſharp or pungent upon the tongue, and has a great diſpoſition to unite with earth, ſo as to appear in a ſolid form; as in common ſalt, alum, &c.

Salts then are foſſile bodies, friable, pellucid, not inflammable, but fuſible by fire, and congealing again in the cold; ſoluble in water, ſo as to diſappear in it, naturally concreting into regularly figured cryſtals, and impreſſing a ſenſation of acrimony on the tongue. Theſe are the characters and qualities common to all ſalts, and to no other bodies: and theſe they always manifeſt when pure and freed from heterogeneous ſubſtances; but in the ſtate in which they are naturally found in the earth, though they have that in their taſte alone which may ſufficiently diſtinguiſh them, yet they do not exhibit all their genuine characters: ſome of them being found ſolid and pure, either within the earth or on its ſurface, but commonly without their proper form; others embodied in earths and ſtones, as the particles or metals in their ores; and others in a fluid ſtate ſuſpended in waters.

Of the foſſils of this claſs, nature therefore affords us three diſtinct orders, and under thoſe they are diſtinguiſhable into five genera. The ſalts of the firſt order are thoſe found native and pure, either in the earth or without its ſurface, and exhibiting all other natural characters, though often without their proper form.

Of the ſecond, are thoſe found not native, but in form of ores, never pure, but diſtinguiſhable by their taſte, and immerſed in and blended with the conſtituent matter of earths and ſtones in extremely ſmall particles. And of the third are thoſe naturally found ſuſpended in waters, and in a fluid form, but ready to aſſume their proper figures on the evaporation of a part of that water.

Of the firſt of theſe orders are the common alimentary ſalt or muria, and the natrum or nitre of the ancients; of the ſecond are alum and nitre; and of the third are borax and halcryptium, an alcaline ſalt hid in the chalybeate waters.

Alimentary ſalt, or muria, is found under a great variety of forms in its different ſtates; but is immediately diſtinguiſhed by applying it to the tongue, and always aſſumes a cubic, pyramidal, or parallelopiped figure after ſolution, and a regular cryſtallization. It is ſuſtained in vaſt quantities in a liquid form among ſea-water, and that of ſalt ſprings; but is alſo found ſolid in the bowels of the earth in vaſt maſſes, which are either of a fine pellucid ſtructure, and called ſal-gem; or various, debaſed, and ſtriated, reſembling the fibroſe talcs, and is the ſal ammoniac of the ancients.

But in which ever of theſe forms this ſalt is found, it affords the ſame cryſtals on evaporation: theſe, according to the degree of heat uſed in the evaporation, are either pyramidal, cubic, or parallelopiped. All theſe ſalts are ſoluble in water; but they require different quantities of it to diſſolve them, and this makes one of their criterions. This ſalt requires thrice and one ſeventh part its own quantity of water, to make a perfect ſolution.

The ſea-water, in different parts of the world, is very differently ſated with it, ſome parts containing twice as much as others. But that of the ſalt-ſprings is always much more ſalted with it, than the ſtrongeſt of the ſea-water: in ſome places it is found loaded with nearly as much as it could be made to contain, ſome ſprings yielding a brine that affords near a quarter of a pound of ſalt, from the pound weight of this liquor, and many of them being ſo ſtrongly impregnated, that the workmen are obliged to let them down or lower them, by mixing them with a large quantity of ſea or common water, before they are fit to be boiled for the ſalt: the common run of ſea-water does not hold ſo much as one fourth part of this quantity, ſome not one eighth of it.

The ſalt produced from the ſea-water of all the parts of the world, and from the brine of all the ſprings of the world, is abſolutely the ſame; but differs in ſtrength, and ſome other qualities, according to the operation by which it is made. In general, the quicker the liquor is evaporated, the weaker is the ſalt; the more time is employed in the proceſs, the ſtronger. This is not wonderful, when we conſider, that, over a gentle heat, water alone, or almoſt alone, evaporates from the liquor, but over a more violent fire, a part of the ſtrength or acid of the ſalt is raiſed with it.

It is upon this principle, and owing to this cauſe, that we find the ſalt of our ſalt ſprings, which is uſually ſold us under the name of baſket-ſalt, the weakeſt of all. It is not that there is any difference in the waters from which theſe ſeveral kinds of ſalt are produced, that they appear to us in different degrees of ſtrength, but that the people who work the brine-pits, make the ſalt with leſs expence of the workman's time; that the ſea-ſalt is formed over ſomewhat ſlower fires; and that the bay-ſalt is made only by the ſun's heat, where the proceſs is very long, and the heat very moderate, and the ſalt is found ſtrong in proportion. This is ſo indiſputable a truth, that once every week, a very ſtrong ſalt, little inferior to bay-ſalt in that quality, is made at the brine-pit works, where the common run of the ſalt is the weakeſt in the world. The liquor is the ſame in this caſe, but the workmen who do not work on Sundays, leave a pan full to evaporate ſlowly over the fire, which they prepare on the Saturday night, and the moderate heat and length of time under which this weekly parcel of ſalt is made, render it very different from the common ſalt of the works, both in form and qualities: it is found to be made up of large and hard grains, inſtead of the ſmall and ſoft ones of the common kind, and is vaſtly ſuperior to it in ſtrength.

This circumſtance, overlooked by the workmen, and even by their maſters too, for many years, gave the hint to Mr. Lownds, and afterwards to the very ingenious Dr. Browning, author of an excellent treatiſe on this ſubject, to propoſe to the government a method of making a ſalt fit for all the purpoſes for which we buy it of our neighbours, only by a new, that is, a ſlower way of working our own brines. The latter of theſe gentlemen has proved, inconteſtably, that we may, if we will encourage proper manufactures, have common ſalt of every kind made at home, equal in ſtrength, and equally fit for all purpoſes, with the ſalt of any part of the world.

After theſe accounts of the muria of common ſalt under its different forms, and as expreſſed by different names, it remains to treat of its qualities and virtues in general.

It reſolves ſpontaneouſly in the air, but this in different times, according to the dampneſs or dryneſs of that element, and according to its own laxer or firmer ſtructure. The coarſer ſalts diſſolve ſooner than the finer,

and there are even ſome pieces of ſal gemmæ ſo firm, that they are ſcarce to be at all affected, even on their ſurface, by the moiſteſt common air.

Common ſalt, added to aqua fortis, enables it to diſſolve gold, making it into what is called aqua regia; by diſtillation it yields a ſtrong and acid ſpirit; it is the moſt of all ſubſtances, endued with keeping animal bodies from putrefaction, and it alſo preſerves vegetables in the ſame manner in long digeſtions. In medicine, it is a common ingredient in clyſters, and ſerves to ſoften and bring away indurated fœces. Suppoſitories are alſo made of a mixture of it with honey, and are put up the fundament, to promote a tendency to deſuctions. Aloes and colocynth are ſometimes added on theſe occaſions, when there is required more power in the medicine. In apoplectic caſes, it is generally an ingredient among the ſtimulating things adminiſtered in clyſters; only it is neceſſary to have this caution, that if there appear reaſon to ſuſpect an inflammation of the inteſtines, or but a tendency to it, every thing of this kind is to be avoided.

Common ſalt that has not been expoſed to a fire, makes no change in the colour of ſyrup of violets; it does not make any efferveſcence with oil of tartar, nor does it make lime-water turbid, but added to ſpirit of ſal armoniac, it manifeſts ſome ſigns of a latent acidity, by rendering it cloudy: on the contrary, alſo, it manifeſts ſomething of an alkaline nature, by rendering a ſolution of mercury whitiſh; and it raiſes an efferveſcence with oil of vitriol, attended with heat.

On ſolution in water, common ſalt manifeſts alſo two very different principles after evaporation. When reduced to a proper conſiſtence, that is, when the quantity of water is not more than as three to one to that of the ſalt, a part of it concretes into grains of ſalt of the ordinary kind; but there remains yet in the liquor, after all that can be ſeparated this way has been procured, a ſtrong taſte of a ſaline nature; the ſalt that gives it this, will never be brought to cryſtallize, but muſt be ſeparated by evaporating all the liquor away; it is then found to be of an alkaline nature, aſſuming no regular form in its cryſtals, and eaſily imbibing the humidity of the air, and running into a liquor with it.

The baſis of ſea-ſalt, therefore, is a mineral alkali, which is ſo intimately blended with its peculiar acid, that the latter has ſcarce any power of exerting itſelf.

The acid, drawn by diſtillation from ſea-ſalt, turns the ſyrup of violets red, and ferments vehemently, though without heat, with oil of tartar; but it does not heat on being poured into lime-water. This ſpirit is the only one that can be properly called a ſolvent for gold and for tin, but ſilver and lead reſiſt it. The acids of nitre and vitriol, alſo, obtain the ſame qualities on being mixed with it, and become aquæ regales. If this acid be perfectly ſaturated with ſalt of tartar, cryſtals of the form and qualities of thoſe of common ſalt may be obtained from the mixture; theſe cryſtals are called regenerated ſea-ſalt, and ſerve to prove what we obſerved above, that an alkali is the baſis of ſea-ſalt, and that more alkalies than one may ſerve to that purpoſe with the peculiar acid, which is the eſſential part of this ſalt.

Phyſicians are of opinion, that ſea-ſalt has the ſame effects in the human body that it has out of it, in checking fermentation, and preventing putrefaction; they therefore eſteem it of good uſe mixed with the generality of our foods in the ſtomach: they are of opinion alſo, that it carries its effect into the blood, and has the qualities of a moderate dryer, detergent and attenuant, added to thoſe of a ſtimulant, which common reaſon declares it to be. Hence may be deduced all the virtues attributed to ſalt, as an aperient, ſtomachic, or warming medicine, and a provocative to venery; but in what degree it poſſeſſes all theſe qualities, we are, by its univerſal uſe in foods, prevented from being able to determine. Van Helmont recommends it as a good preſervative againſt the ſtone and gravel: he has been ſeverely cenſured for this by others, who are of opinion, that all ſalted foods, ſuch as ſalt beef, and the like, are very bad in thoſe caſes: but both parties may be in the right; for there is a great deal of difference between common ſalt eaten with the freſh juices of our food, and the brine and pickle into which it runs in the time of its being left upon the meat preſerved by it. Salt is very properly put into the mouths of people in apoplectic fits, as it not only irritates but attenuates the juices there, and promotes a diſcharge of them; and in a palſy which affects the tongue, a ſage-leaf, bruiſed and covered with ſalt, has been a famous remedy among the good women, and not without reaſon.

Mixed with bran, and heated in a canvas bag, it is recommended to be applied externally to the head in head-achs, ariſing from a moiſt cauſe, and in defluxions; and we find the old phyſicians very ſtrenuouſly recommending a cataplaſm made of the ſame ingredients for pains.

Methods of making alimentary SALT are theſe: 1. By the evaporation of the ſun's rays: this is the moſt eaſy and ſimple method of all, when the water of ponds and lakes, whether natural or artificial, impregnated with ſalt, being wholly exhaled by the force of the ſun and air, the ſalt is concreted into a hard cruſt at the bottom of the lake, and is what commonly goes by the name of bay-ſalt; the cryſtals of which differ in ſize, according to the different degrees of heat, and the time it lies in the pits. All bay-ſalt has ſome mud, ſlime, or the like, in the making, and ſome kinds are mixed with the bittern-ſalt, or what is called Epſom ſalt; they are all more white while dry, and more pellucid when moiſt, and they differ in colour, according to the earth which makes the bottoms of the pits. Thus, ſome of the French bay-ſalt is grey, ſome reddiſh, and ſome white, according as a blue clay has lined the pits, or a red, or white one. Some kinds have an agreeable ſmell in large heaps; ſuch are the Portugal, and the Hampſhire bay-ſalts; and this ſeems owing to the ſea-water they were made from, having a bituminous matter in it. It differs alſo greatly in taſte, according to the various foreign mixtures it contains; and it will often alter in taſte, and other qualities, by long keeping: for, in general, it is much fitter for uſe, after it has been kept ſome time in a dry place, than when it is firſt made.

2. By boiling, or coction, the moſt convenient works for which proceſs are conſtructed in the following manner: the ſaltern or boiling houſe is erected near the ſea-ſhore, and is furniſhed with a furnace and one or two large pans, which are commonly made of iron plates, jointed together with nails, and the joints filled with a ſtrong cement; and the bottoms of the pans are prevented from bending down, by being ſupported by ſtrong iron-bars.

The ſalt pan being filled with ſea-water, a ſtrong fire of pit coal is lighted in the furnace, and then, for a pan which contains about fourteen hundred gallons, the ſalt-boiler takes the whites of three eggs, and incorporates them all with two or three gallons of ſea-water, which he pours into the ſalt pan, while the water contained therein is only lukewarm, and mixes this with the reſt by ſtirring it about with a rake. In many places they uſe inſtead of eggs the blood of ſheep or oxen to clarify the ſea-water; and in Scotland they do not give themſelves the trouble of clarifying it at all. As the water heats, there ariſes a black frothy ſcum upon it, which is to be taken off with wooden ſkimmers. After this, the water appears perfectly clear, and, by boiling it briſkly about four hours, a pan loaded in the common way, that is about fifteen inches deep, will begin to form cryſtals upon its ſurface. The pan is then filled up a ſecond time with freſh ſea-water; and, about the time when it is half filled, the ſcratch pans are taken out and emptied of a white powder, ſeeming a kind of calcareous earth, which ſeparates itſelf from the ſea-water, during its boiling, before the ſalt begins to ſhoot. When theſe have been emptied, they are again put into their places, where they are afterwards filled again. This powder, being violently agitated by the boiling liquor, does not ſubſide till it comes to the corners of the pan, where the motion of the maſs is ſmaller, and it there falls into theſe pans placed on purpoſe to receive it.

The ſecond filling of the pan is boiled down after clarifying in the ſame manner as the firſt, and ſo a third and a fourth; but in the evaporation of the fourth, when the cryſtals begin to form themſelves, they ſlacken the fire, and only keep the liquor ſimmering. In this heat they

they keep it all the while that the ſalt is granulating, which is nine or ten hours. The granules or cryſtals all fall to the bottom of the pan; and when the water is almoſt all evaporated, and the ſalt nearly dry at the bottom, they rake it altogether into a long heap on one ſide of the pan, where it lies a while to drain from the brine, and then is put into barrows, and carried to the ſtore-houſe, and delivered into the cuſtody of his majeſty's officers. In this manner the whole proceſs is uſually performed in twenty-four hours, the ſalt being commonly drawn out every morning. This is the method in moſt of our ſalt works, but in ſome they fill the pan ſeven times before they boil up the ſalt, and ſo take it out but once in two days, or five times in a fortnight. In the common way of four boilings, a pan of the uſual ſize, containing one thouſand three-hundred gallons, they draw from fifteen to twenty buſhels of ſalt every day, each buſhel weighing fifty-ſix pounds.

When the ſalt is carried into the ſtore-houſe, it is put into drabs, which are partitions, like ſtalls for horſes, lined at three ſides, and the bottom with boards, and having a ſliding-board on the foreſide to draw up on occaſion. The bottoms are made ſhelving, being higheſt at the back, and gradually inclining forwards; by this means the brine, remaining among the ſalt, eaſily ſeparates and runs from it, and the ſalt in three or four days becomes ſufficiently dry; in ſome places they uſe cribs and barrows, which are long and conic wicker-baſkets for this purpoſe, and in ſome places wooden troughs with holes in the bottom. The ſaline liquor which remains after the making of ſalt is what is called bittern.

Much in the ſame manner is the ſalt obtained from the brine of ſalt ſprings, pits, &c. White ſalt is prepared from ſea water, or any other kind of ſalt-water, firſt heightened into a ſtrong brine by the heat of the ſun, and the operation of the air. It may alſo be prepared from a ſtrong brine, or lixivium, drawn from earths, ſtones, or ſands, ſtrongly impregnated with common ſalt. Refined rock ſalt is that obtained by diſſolving foſſile or rock-ſalt in ſalt of freſh water, and afterwards boiling the ſolution. And, laſtly, ſalt upon ſalt is made from bay-ſalt diſſolved in ſea-water, or other water, and boiled to a white ſalt.

SALT, in chemiſtry, makes one of the leading and moſt active principles, or elements, procurable from mixed bodies.

There are three kinds thus obtained, two of which are volatile, and the third fixed. The volatile, are acid and urinous ſalts; the fixed, lixivious, or thoſe drawn from aſhes: the urinous and lixivious ſalts are alſo called alcalies, or alcalious ſalts; the former being volatile, and the latter fixed.

Acid ſalts are ranged, by Homberg, under three claſſes, viz. ſuch as contain an animal or vegetable ſulphur; as all the acids diſtilled from plants, fruits, woods, &c. and ſpirit of nitre: ſuch as contain a bituminous ſulphur; to which belong the acids of vitriol, common ſulphur, and alum: and ſuch as contain a more fixed mineral ſulphur; as the acids drawn from the ſea-ſalt, and ſal-gem. Thoſe of the firſt claſs act more ſwiftly than thoſe of the others, and thoſe of the ſecond are the leaſt nimble. Acid ſalts, joined with lixivious ones, compoſe mixed or intermediate ſalts: thus, ſpirit of nitre, with ſalt of tartar, produce a true ſalt-petre; ſpirit of ſalt, with ſalt of tartar, produce true common ſalt; and ſpirit of vitriol, with ſalt of tartar, produce true vitriol; which are all mixed or intermediate ſalts, i. e. partly fixed and partly volatile, the ingredients ſtill retaining their original natures. Acids, joined with urinous ſalts, compoſe another ſalt called ammoniac ſalts, which are always volatile.

In all native ſalts, both foſſile, vegetable, and animal, after the violence of the fire has ſeparated all the volatile parts, there ſtill remains a fixed ſalt, to be drawn from the fœces by lotion, or lixiviation; hence called a lixivious ſalt, which is no other but the relics of the acid ſalts, that the fire was not able to ſeparate from the earth of the mixed body, but may be ſeparated by diſſolving them in common water. The taſte of theſe lixivious ſalts is very different, according to the quantity of the acids ſtill remaining after calcination; part of which is ſtill capable of being volatilized by a more intenſe heat, or by diſ-

ſolution, digeſtion, filtration, and evaporation frequently repeated; or, by adding ſome urinous ſalt, to abſorb the ſame.

We have three ſorts of urinous ſalts, viz. that of plants or animals, which is the ſame; the ſecond is foſſile; and the third of an intermediate kind, partaking both of the foſſile and vegetable nature; the firſt is volatile, and the two latter fixed. By urinous ſalts, we mean all ſuch as partake of the taſte or ſmell of urine; their effect in volatilizing fixed ſalts is well known; for being added to common ſalt, there ariſes, by fire, a volatile ſalt, called ſal ammoniac. However, for volatilizing the fixed ſalts of plants, the urinous ſalts of plants are not ſo proper as the urinous ſalts of the intermediate claſs, ſuch as alum; and for the fixed ſalts of foſſils, the urinous ſalt is fitteſt, viz. borax.

All the ſorts, then, appear evidently compounded and unelementary; and that they are producible *de novo*, and convertible into one another, is ſtrenuouſly argued by Mr. Boyle. The two chief qualities wherein they all agree, he obſerves, are to be eaſily diſſoluble in water, and to affect the palate, ſo as to cauſe a ſenſe of taſte. Now that a diſpoſition to be diſſoluble in a liquor, may be acquired by mixture, and a new texture of parts, appears from many inſtances; and as for the taſte, it is ſome queſtion, how far the neceſſity thereof may conſiſt with another principle; for the pureſt oils are ſapid, yet will not diſſolve in water; ſo that there does not appear any ſtrict connection between being ſapid and ſoluble in that fluid.

For acid ſalts, we may inſtance in nitre: which, though it have no acid taſte, may be made to afford by diſtillation, above three quarters of its weight, of a highly acid liquor; yet it does not appear, that ſuch a great proportion of acid particles, or poſſibly any proportion at all, is employed by nature in the compoſition of nitre.

For urinous ſalts, we have an inſtance of their production, in the ſalt obtained by diſtillation from ſoot: for though the wood we burn in our chimneys, ſeems to have nothing of the taſte or ſmell of urine, nor have the diſſolutions of the ſaline parts of ſuch wood been obſerved to have any affinity, in taſte or odour, thereto; yet when wood is burnt in the fire, and the ſoot afforded by it diſtilled, we get a white volatile urinous ſalt, like what is obtained from blood, urine, or the like.

For lixivious, or the fixed ſalts of calcined bodies, the chemiſts themſelves are not entirely agreed; for however the prevailing opinion may be, that thoſe fixed alkalies pre-exiſt in mixed bodies, Helmont very ingeniouſly propoſes another origin, and holds them, as to their alkaline form, productions of the fire, by whoſe violent action a part of the ſalt, which in the concrete is all naturally volatile, laying hold of ſome parts of the ſulphur of the ſame body, both become melted together, and thus fixed into an alkali.

It would, no doubt, contribute greatly to the improvement of chemiſtry, and natural philoſophy, to form a table of the time and quantity wherein all the known ſalts are diſſoluble in water, Epſom-ſalt preſently diſſolves in about an equal quantity of water; common ſalt diſſolves in about four times; nitre, in about five or ſix times; and ſalt of tartar, in about twice its own quantity of boiling water, to diſſolve it. Such a table, regularly formed, might eaſe the trouble of refining ſalts; by ſhewing, at once, how much water each ſalt requires to diſſolve it, for clarification, or cryſtallization. It would likewiſe ſupply us with a ready and commodious way of ſeparating any mixture of ſalts, by ſhewing which would ſhoot out of the mixture firſt upon cryſtallization; for the rule is, that the ſalt which requires the largeſt proportion of water to diſſolve it, will ſhoot the firſt; and thus it is, that nitre is totally ſeparated from common ſalt, in the ordinary proceſs for refining it.

The ſame table might alſo direct us to a ready method of ſeparating two ſalts, without waiting for cryſtallization; thus, ſuppoſe tartar of vitriol were mixed with Epſom ſalt, if water be poured upon the mixture, it will preſently drink in the Epſom ſalt, leaving the tartar of vitriol untouched; and the ſame is to be underſtood of other mixtures of ſalts.

If, ſays Dr. Shaw, the phyſical reaſon be demanded, why one ſalt more readily diſſolves in water than another, we recommend it to farther examination, whether all ſalts do not diſſolve in water with greater or leſs facility, and in greater or leſs proportion, according as they contain more or leſs of a groſs, unctuous ſubſtance, unſuitable to the nature or fineneſs and lubricity of parts required in water. The comparing Epſom ſalt, ſalt of tartar, common ſalt, &c. with nitre, alum, crude tartar, &c. he thinks will make this more than a conjecture. Hence, in order to leſſen the trouble and expence of procuring the volatile ſalt of animal ſubjects, they ſhould be firſt purged of their oil and unctuous parts, by boiling in water; after which, they will afford volatile ſalts and ſpirits, as pure, or purer, than thoſe obtained from unboiled hartſhorn.

The ſame gentleman obſerves farther, that the unrectified volatile ſalts of vegetable and animal ſubſtances, are true ſales volatiles oleoſi; and according to the difference of the oil wherein they abound, they are properly diſtinguiſhed into ſalt of hartſhorn, of ox-bone, of human blood, of ſilk, &c. But that when theſe oils are totally ſeparated from them, they become one and the ſame undiſtinguiſhable volatile ſalt; for that it is the admixture of oil that gives the colour to volatile ſalts, they being permanently white when the oil is ſeparated.

Theſe volatile ſalts are obtainable from all kinds of land animals, the amphibious and ſubterraneous tribe, birds, fiſhes, and reptiles; alſo from alkaline vegetables without putrefaction, and from other vegetables after putrefaction; from ſoot, horns, hoofs, and all refuſe animal and vegetable matters, as urine, the blood of ſlaughter houſes, &c. and this as pure and perfect as from hartſhorn; whence volatile alkalies, and ſal ammoniac, might be afforded very cheap.

The volatile animal, and fixed vegetable ſalts, differ chiefly with regard to their volatility, and fixedneſs, and the effects thereon depending; but agree in other reſpects: thus they both make an effervеſcence, and turn neutral, when ſaturated with acids; they are corroſive, hot, and fiery, &c.

SALTIER, in heraldry, an ordinary in form of a St. Andrew's croſs; which may be ſaid to be compoſed of a bend dexter and ſiniſter, croſſing each other in the center of the eſcutcheon.

SALT PETRE, the ſame with nitre. See the article NITRE.

SALVAGE MONEY, a reward allowed by the civil and ſtatute law, for the ſaving of ſhips or goods from the danger of the ſeas, pirates, or enemies.

Where any ſhip is in danger of being ſtranded, or driven on ſhore, juſtices of the peace are to command the conſtables to aſſemble as many perſons as are neceſſary to preſerve it; and, on its being preſerved by their means, the perſons aſſiſting therein ſhall, in thirty days after, be paid a reaſonable reward for the ſalvage, otherwiſe the ſhip or goods ſhall remain in the cuſtody of the officers of the cuſtoms, as a ſecurity for the ſame.

SALVATELLA, in anatomy, a branch of the axillary vein, which runs over the back of the hand towards the little finger.

SALUTATION, the act of ſaluting, greeting, or paying reſpect and reverence to any one.

There is a great variety in the forms of ſalutation. The orientals ſalute by uncovering their feet, laying their hands on their breaſts, &c. In England, we ſalute by uncovering the head, bending the body, &c. The pope makes no reverence to any mortal, except the emperor, to whom he ſtoops a very little, when he permits him to kiſs his lips. A prince, or perſon of extraordinary quality, is ſaluted at his entering a garriſon by the firing of the cannon round the place. In the field, when a regiment is to be reviewed by a king, or general, the drums beat, as he approaches, and the officers ſalute him one after another, as he paſſes by, ſtepping back with the right foot and hand, bowing their ſpontons to the ground, and then recovering them gently, bringing up the foot and hand, planting them; which done, they pull off their hats without bowing. The enſigns ſalute all together, bringing down their colours near the ground directly before them at one motion, and having taken them up again, gently lift their hats.

At ſea, they ſalute by a diſcharge of cannon, which is greater or leſs, according to the degree of reſpect they would ſhew; and here ſhips always ſalute with an odd number of guns, and galleys with an even one. To ſalute with muſkets is to fire one, two, or three volleys; which is a method of ſalutation that ſometimes precedes that of cannon, and is uſed on occaſion of feaſts. After the cannon, they alſo ſometimes ſalute or hail with the voice, by a joint ſhout of all the ſhip's company, repeated three times; which ſalutation alſo occaſionally obtains where they carry no guns, or do not care to diſcharge any. Saluting with the flag is performed two ways, either by holding it cloſe to the ſtaff ſo as it cannot flutter, or by ſtriking it ſo as it cannot be ſeen at all, which is the moſt reſpectful. Saluting with the ſails is performed by hovering the top-ſails half-way of the maſts. Only thoſe veſſels that carry no guns ſalute with the ſails.

SAMARITANS, an antient ſect among the Jews, ſtill ſubſiſting in ſome parts of the Levant, under the ſame name.

Its origin was in the time of Rehoboam, under whoſe reign the people of Iſrael were divided into two diſtinct kingdoms, that of Judah and that of Iſrael; the capital of the latter being Samaria, the Iſraelites obtained the name of Samaritans.

They were antiently guilty of idolatry, and the rabbins pretend, that they worſhipped the figure of a dove on mount Gerizim; but the preſent Samaritans, who are but few in number, are far from being idolaters. They celebrate the paſſover every year, on the fourteenth day of the firſt month, on mount Gerizim, and begin that feaſt with the ſacrifice appointed for that purpoſe in Exodus: they keep the ſabbath with all the rigour with which it is injoined in the book of Exodus, none among them ſtirring out of doors but to the ſynagogue; they ſacrifice no where but on mount Gerizim: they obſerve the feaſts of expiation, tabernacles, harveſt, &c. and never defer circumciſion beyond the eighth day; they never marry their nieces as the Jews do; have but one wife; and, in fine, do nothing but what is commanded in the law.

SAMARITAN MEDALS, ſome antient medals in the cabinets of our antiquaries, the inſcriptions and legends of which are in Hebrew; but the character different from the Hebrew of our Bibles, which is the ſquare Hebrew, or Chaldee; from this character, and not from their being ſtruck by the Samaritans, they are denominated Samaritan.

Of theſe there are four kinds: the firſt bear expreſsly the name of Simon, and the ſubject for which they were ſtruck, viz. the deliverance of Jeruſalem. The ſecond have not the name Simon, but only the deliverance of Sion or Jeruſalem. The third, have neither Simon, nor the deliverance of Sion; but only the epochas, firſt year, ſecond year, &c. The fourth claſs have neither any inſcriptions, nor any thing whence we may judge of the time when they were ſtruck. The three firſt were certainly ſtruck by the Jews, after their return from the Babyloniſh captivity, and in the time of Simon Maccabeus, after Jeruſalem had been freed from the yoke of the Greeks; but though they were ſtruck after the captivity, the learned jeſuit Souciet obſerves, that their character ſhews itſelf to be that of the antient Hebrew, the uſe of which was loſt by the people during their ſojourn in Babylon and Chaldæa; but was again reſtored after their return, on the ſame footing as before.

SAMBUCUS, the *Elder*, in botany, a genus of plants, the flower of which conſiſts of a ſingle rotated ſemiquinquifid petal; its fruit is a roundiſh unilocular berry, containing three ſeeds, convex on one ſide and angulated on the other.

The inner green bark of this ſhrub is gently cathartic: an infuſion of it in wine, or its expreſſed juice, in the doſe of half an ounce, or an ounce, is ſaid to purge moderately; and in ſmall doſes, to prove an efficacious deobſtruent, capable of promoting all the fluid ſecretions. The young buds, or rudiments of the leaves, are ſtrongly purgative, but are reckoned unſafe. The expreſſed juice, in-

ſpiſſated to the conſiſtence of a rob, proves an uſeful aperient medicine, which is good in obſtructions of the viſcera, and promotes the natural evacuations.

SAMBUCUS is alſo an antient muſical inſtrument of the wind-kind, reſembling a flute; probably thus called, becauſe made of elder.

SAMIAN EARTH, in the materia medica, the name of two ſpecies of marl uſed in medicine, viz. 1. The white kind, called by the antients, collyrium Samium; being aſtringent, and therefore good in diarrhæas, dyſenteries, and hæmorrhages; they alſo uſed it externally in inflammations of all kinds. 2. The browniſh-white kind, called after Samius, by Dioſcorides; this alſo ſtands recommended as an aſtringent.

SAMOSATENIANS, in church-hiſtory, the ſame with Paulianites. See the article PAULIANITES.

SAMPSEANS, in church-hiſtory, an antient ſect, who were properly neither Jews, Chriſtians, nor Gentiles, though they took their name from the Hebrew word *Semes*, ſun; as though they worſhipped that planet.

They acknowledged only one God; waſhed themſelves often; and in almoſt every thing attached themſelves to the religion of the Jews. Many among them abſtained wholly from eating of fleſh. Scaliger will have the Sampſeans to be the ſame with the Eſſeni; and, indeed, the Sampſeans, Eſſeni, Alceſaites, and Maſſalians, appear to be no more than ſo many different names for the ſame ſect.

SANBENITO, or SACO BENITO, a kind of linnen garment worn by perſons condemned by the inquiſition. See the articles INQUISITION and *Act of* FAITH.

SANCTIFICATION, the act of ſanctifying, or rendering a thing holy.

The reformed divines define ſanctification to be an act of God's grace, by which a perſon's deſires and affections are alienated from the world, and by which he is made to die to ſin, and to live to righteouſneſs; or, in other words, to feel an abhorrence of all vice, and a love of virtue and religion.

SANCTION, the authority given to a judicial act, by which it becomes legal and authentic.

SANCTUARY, among the Jews, alſo called Sanctum Sanctorum, or holy of holies, was the holieſt and moſt retired part of the temple of Jeruſalem, in which the ark of the covenant was preſerved, and into which none but the high prieſt was allowed to enter, and that only once a year, to intercede for the people.

Some diſtinguiſh the ſanctuary from the ſanctum ſanctorum, and maintain that the whole temple was called the ſanctuary.

To try and examine any thing by the weight of the ſanctuary, is to examine it by a juſt and equal ſcale: becauſe, among the Jews, it was the cuſtom of the prieſts to keep ſtone weights, to ſerve as ſtandards for regulating all weights by, though theſe were not at all different from the royal, or profane weights.

Sanctuary, in the Romiſh church, is alſo uſed for that part of the church in which the altar is placed, incompaſſed with a rail or balluſtrade.

SANCTUARY, in our antient cuſtoms, is the ſame with aſylum. See ASYLUM.

SAND, *Arena*, in natural hiſtory, a genus of foſſils, the characters of which are, that they are found in minute concretions; forming together a kind of powder, the genuine particles of which are all of a tendency to one determinate ſhape, and appear regular, though more or leſs compleat concretions; not to be diſſolved or diſunited by water, or formed into a coherent maſs by means of it, but retaining their figure in it; tranſparent, vitrifiable by extreme heat, and not diſſoluble in, nor effervеſcing with, acids. Sands are ſubject to be variouſly blended both with homogene and heterogene ſubſtances, as that of talcs, &c. and hence, as well as from their various colours, are ſubdivided into, 1. White ſands, whether pure or mixed with other arenaceous or heterogeneous particles; of all which there are ſeveral ſpecies, differing no leſs in the fineneſs of their particles, than in the different degrees of colour, from a bright and ſhining white, to a browniſh, yelloviſh, greeniſh, &c. white. 2. The red and reddiſh ſands, both pure and impure. 3. The yellow ſands, whether pure or mixed, are alſo very numerous. 4. The brown ſands, diſtinguiſhed in the ſame manner. 5. The black ſands, whereof there are only two ſpecies, viz. a fine ſhining greyiſh black ſand, and another of a fine ſhining reddiſh-black colour. 6. The green kind, of which there is only one known ſpecies, viz. a coarſe variegated duſky green ſand, common in Virginia.

Sand is of great uſe in the glaſs-manufacture; the white writing ſand being employed for making of the white glaſs, and a coarſe greeniſh-looking ſand for the green glaſs.

In agriculture, it ſeems to be the office of ſand to make unctuous earth fertile, and fit to ſupport vegetables, &c. For earth alone, we find, is liable to coaleſce, and gather into a hard coherent maſs, as appears in clay; and being thus embodied, and as it were glued together, is no way diſpoſed to nouriſh vegetables. But if ſuch earth be mixed with ſand, its pores are thereby kept open, and the earth itſelf looſe, ſo as thus to give room for the juices to aſcend, and for plants to be nouriſhed thereby. A vegetable planted only in ſand, or in a fat glebe, or in earth, receives little growth or increaſe; but a mixture of both renders the maſs fertile. In effect, earth is in ſome meaſure made organical by means of ſand; pores and ſpaces, ſomething analogous to veſſels, being thereby maintained, by which the juices may be conveyed, prepared, digeſted, circulated, and at length diſcharged.

Common ſand is a very good addition, by way of manure, to all ſorts of clay-lands; it warms them, and makes them more open and looſe. The beſt ſand for the farmer's uſe is that which is waſhed by rains from roads or hills, or that which is taken from the beds of rivers; the common ſand that is dug in pits never anſwers nearly ſo well. However, if mixed with dung, it is much better than laid on alone: and a very fine manure is made by covering the bottom of ſheep folds with ſeveral loads of ſand every week, which are to be taken away, and laid on cold ſtiff lands, impregnated as they are with the dung and the urine of the ſheep.

Beſide clay-land there is another ſort of ground very improveable by ſand; this is that ſort of black foggy land on which buſhes and ſedge grow naturally, and which they cut into turf, in ſome places. Six hundred load of ſand being laid upon an acre of this land, according to the Cheſhire-meaſure, which is near double the ſtatute acre, meliorate it ſo much, that without plowing, it will yield good crops of oats or tares, though before it would have produced ſcarce any thing. If this crop is taken off, the land be well dunged, and laid down for graſs, it will yield a large crop of ſweet hay.

Once ſanding this land will improve it for a vaſt number of years, and it will yield two crops of hay in the year, if there be weather to make it in. Some land in Cheſhire has been, by this means, rendered of twelve times its former value to the owner. The bogs of Ireland when drained, have been rendered very fruitful land, by mixing ſand in this manner among the earth, of which they conſiſt. Add to this, that in all theſe boggy lands, the burning them, or firing their own turf upon them, is alſo a great advantage. The common peat, or turf-aſhes, mixed with the ſand for theſe purpoſes, add greatly to its virtue. Sea-ſand, which is thrown up in creeks and other places, is by much the richeſt of all ſand for manuring the earth; partly its ſaltneſs, and partly the fat and unctuous filth that is mixed among it, give it this great virtue. In the weſtern parts of England, that lie upon the ſea-coaſt, they make very great advantages of it. The fragments of ſea-ſhells alſo, which are always in great abundance in this ſand, add to its virtues; and it is always the more eſteemed by the farmers, the more of theſe fragments there are among it.

The ſea-ſand, uſed as manure in different parts of the kingdom, is of three kinds: that about Plymouth, and on other of the ſouthern coaſts, is of a blue-grey colour like aſhes, which is probably owing to the ſhells of muſcles, and other fiſh of that or the like colour, being broken and mixed among it in great quantity. Weſtward, near the Land's end, the ſea-ſand is very white, and

about the isles of Scilly it is very glistering, with small particles of talc; on the coasts of the North Sea, the sand is yellowish, brown, or reddish, and contains so great a quantity of fragments of cockle-shells, that it seems to be chiefly composed of them. That sea-sand is accounted best, which is of a reddish colour: the next in value to this is the bluish, and the white is the worst of all. Sea-sand is best when taken up from under the water, or from sand-banks, which are covered by every tide. The small grained sand is most sudden in its operation, and is therefore best for the tenant who is only to take three or four crops; but the coarse or large grained sand is much better for the landlord, as the good it does lasts many years.

When the land has been well manured with the large sand, they take four crops of corn from it, and then lay it down for pasture for six or seven years before they plow it again. The grass is so good, that they commonly mow it for hay the first year; it always abounds very much with the white-flowered clover. If the grass grows but short, it is the farmer's interest to feed his cattle upon it, and it will turn to as good account this way, being very sweet and rich, and making the cattle fat, and the cows yield a very large quantity of milk.

SAND-Bags, in the art of war, are bags filled with earth or sand, holding each about a cubic foot: their use is to raise parapets in haste, or to repair what is beaten down.

SAND-Eel, *Ammodytes*, in ichthyology. See Ammodytes.

SAND-Flood, a terrible mischief, incident to the lands of Suffolk, and some others parts of England; which are frequently covered with vast quantities of sand, rolling in upon them like a deluge of water, from sandy hills in their neighbourhood.

The best way of stopping its progress is, by hedges of furze, planted one over another as they become level.

Sand-Lands, or Sandy Lands, in agriculture, are made up of sands of different colours and qualities; as white, blackish, reddish, or yellowish; and in the size of their particles, some being milder or harsher, and others very light, seeming mere dust. The grey, black, and ash-coloured sands are the worst of all, and are generally found on heaths and commons.

The most suitable plants for arable lands of this kind are white oats, rye, black wheat, and turneps: the natural produce in weeds, is quick-grass, sorrel, broom, furze, fern, and heath. The best manure for them is either marl or such clay as will break with the frosts. Cow-dung is also said to be good for such lands; and many use with success chalk, mud, and the half rotten straw of dunghills.

SANDAL, in antiquity, a rich kind of slipper, worn on the feet by the Greek and Roman ladies, made of gold, silk, or other precious stuff, consisting of a sole, with an hollow at one extreme to embrace the ancle, but leaving the upper part of the foot bare.

SANDARACH, in natural history, a very beautiful native fossil, though too often confounded with the common factitious red arsenic, and with the red matter formed by melting the common yellow orpiment.

It is a pure substance, of a very even and regular structure, is throughout of that colour which our dyers term an orange-scarlet, and is considerably transparent even in the thickest pieces. But though with respect to colour, it has the advantage of cinnabar while in the mass, it is vastly inferior to it when both are reduced to powders. It is moderately hard, and remarkably heavy, and when exposed to a moderate heat, melts and flows like oil: if set on fire, it burns very briskly.

It is found in Saxony and Bohemia, in the copper and silver mines, and is sold to the painters, who find it a very fine and valuable red: but its virtues or qualities in medicine, are no more ascertained at this time, than those of the yellow orpiment.

Gum-Sandarach, is a dry and hard resin, usually met with in loose granules, of the bigness of a pea, a horse-bean, or larger; of a pale whitish yellow, transparent, and of a resinous smell, brittle, very inflammable, of an acrid and aromatic taste, and diffusing a very pleasant smell when burning. It is produced from a species of the juniper, and the cedrus baccifera. See Juniper.

It flows only from these trees in hot countries; but the natives promote its discharge by making incisions in the bark.

What is obtained from the cedar is more fragrant, especially when burnt; but it is seldom to be met with separate in the shops, both being mixed together under the common name of sandarach.

Sandarach is good in diarrhœas, and in hæmorrhages; where its dose is from ten grains to half a dram: it is also sometimes prescribed in gonorrhæas, and the fluor albus; but at present it is much disused in medicine. It is, however, much used by our writing-masters, who make a powder of it which they call pounce.

The varnish-makers make a kind of varnish of it by dissolving it in oil of turpentine, or linseed, or in spirit of wine.

SANDIVER, a whitish salt, continually cast from the metal, as it is called, whereof glass is made; and swimming on its surface, is skimmed off.

Sandiver is also plentifully thrown out in the eruptions of vulcanos; some is of a fine white, and others tinged blueish, or yellowish.

Sandiver is detergent, and good for foulnesses of the skin. It is also used by gilders of iron.

SANDIX, a kind of minium, or red-lead, made of ceruse; but much inferior to the true minium. See the articles Minium and Ceruse.

SANGUIFICATION, in the animal œconomy, the conversion of chyle into true blood.

Blood is formed from chyle by various and successive degrees. A few hours after meals, the chyle is found conveyed into the blood, though not assimilated. Hence, when after a liberal meal blood is taken from the vein, besides the serum and the red part, there is a white, sweet, and chylous part found fluctuating in the blood. In a few hours the chyle, conveyed with the blood thro' the vessels, is separated from the blood by the fabric of the breasts, and affords milk, which is of a different nature both from blood and chyle; for in milk there begins to be formed that tendency to concretion which is already present in the serum of the blood, for it yields cheese. But this tendency to concretion is never found in the chyle. Hence we may artificially imitate the preparation of chyle in emulsions, but never the nature of milk.

When a sound woman for twelve hours totally abstains from meat and drink, her milk begins to be saline and yellowish. If she abstains still longer, nothing is found in the blood taken from her veins, but what (like the white of an egg) is, by means of the fire, concreted, which never happens in the chyle.

Hence we may conclude, that the bodies of sound persons are the formers and producers of their own blood, in the same manner as any plant, by its peculiar fabric, prepares its sap from the juices of the fertile earth and the genial influences of the circumambient air.

But in the human body the formation of blood depends principally upon the efficacy of the circulation, by which the vessels act upon their contained fluids. Hence in the most robust persons the blood is reddest, or rather almost black, in consequence of its saturated red colour, and is concreted almost the very moment it is left in a state of rest. And in acute diseases, when the circulation is encreased, all the parts are intensely red, and the serum of the blood is converted into a sizzle mass. But in weak persons in whom the efficacy of the circulation is far less, all the parts are pale and languid, whilst the blood is thin and hardly capable of concretion. But when in such persons, with due exercise and proper remedies, the circulation is augmented, the red colour and due cohesion of the blood return.

SANGUINARIA, Blood-wort, a genus of plants, the flower of which consists of eight very patent petals; and the fruit is an oblong ventricose capsule, containing a great many roundish and acuminated seeds.

SANGUINE, in general, something abounding with, or resembling blood.

Among

Among heralds, the term ſanguine is often given to the colour more uſually called murrey; being made of red lake tinged with a little Spaniſh brown; it is chiefly uſed in the coats of the knights of the Bath, and is repreſented, in engraving, by hatches like thoſe of purpure. See PURPURT.

SANGUIS, BLOOD, in the animal œconomy. See BLOOD.

SANGUISORBA, BURNET, in botany. See the article BURNET.

SANHEDRIM, or SANHEDRIN, among the Jews, the great council of the nation, conſiſting of ſeventy ſenators, taken partly from among the prieſts and Levites, and partly out of the inferior judges, who formed what is called the leſſer ſanhedrim. The room they met in, was a rotunda, half of which was built without the temple, and half within. The naſi, or preſident of the ſanhedrim, ſat upon a throne, with his deputy on his right hand, his ſub-deputy on his left, and the other ſenators ranged in order on each ſide.

The authority of this council was very extenſive, for they decided ſuch cauſes as were brought before them by way of appeal from the inferior courts; and the king, the high prieſts, and prophets, were under the juriſdiction of this tribunal. They had the right of judging in capital caſes, and ſentence of death might not be pronounced in any other place; for which reaſon the Jews were forced to quit this hall, when the power of life and death was taken out of their hands, forty years before the deſtruction of the temple, and three years before the death of Chriſt.

There were ſeveral inferior ſanhedrims in Paleſtine, each of which conſiſted of twenty-three perſons; all theſe depended on the great ſanhedrim of Jeruſalem.

SANIES, in medicine, a ſerous putrid matter, iſſuing from wounds; it differs from pus, which is thicker and whiter.

SANTALUM, SAUNDERS, in the materia medica, a hard, odoriferous medicinal wood, brought from the Eaſt-Indies, of which there are three ſorts, viz. the yellow, white, and red; the yellow or citrine ſaunders, is a beautiful wood; of the colour of lemon-peel; of a ſmell ſomewhat like a mixture of muſk and roſes, and of a ſomewhat acrid and aromatic taſte, with a ſlight bitterneſs. The white ſanders reſembles the yellow, and is of the ſame fragrant ſmell and aromatic taſte, but in a more remiſs degree. Both theſe ſorts ſhould be choſen ſound, firm, heavy, and of a good ſmell when cut; they ſhould alſo be choſen in the block, and not cut into chips as they uſually are, for in this manner they ſoon loſe much of their virtue. The red ſaunders is of a denſe and compact texture, remarkably heavy and very hard. It is brought to us in logs of conſiderable length, the out part of which is of a duſky, and the inner of a blood red; it has but little ſmell, and is of an auſtere taſte.

All theſe ſorts are attenuants, and all have an aſtringency, but the red moſt of all. They are accounted cordials, and are ſaid to be good in obſtructions of the viſcera; but they are little uſed, except as ingredients in ſome of the compoſitions of the ſhops.

SANTOLINA, FEMALE SOUTHERN-WOOD, or LAVENDER-COTTON, a plant, the compound flower of which is uniform, conſiſting of a number of infundibuliform hermaphrodite corollulæ, quinquifid at the limb; which are each followed by a ſingle ſeed, contained in the cup.

The medicinal virtues aſcribed to ſantolina, are, in general, the ſame with thoſe of the abrotanum mas, or male ſouthern-wood: it is however particularly recommended in uterine complaints; and its ſeed is good for deſtroying worms. See the article SOUTHERN-WOOD.

SAP, in phyſiology, a juice furniſhed by the earth, and changed into the plant, conſiſting of foſſil parts, other parts derived from the air and rain, and others from putrified animals, plants, &c. See the article JUICE.

This juice enters the plant in form of a fine and ſubtile water, which the nearer it is to the root, the more it retains of its proper nature; and the farther from the root, and the more action it has ſuſtained, the nearer it approaches to the nature of the vegetable: conſequently, when the juice enters the root, it is earthy, watery, poor, acid, and ſcarcely oleaginous at all. In the trunk and branches it is farther prepared, though it ſtill continues acid, as we find by tapping a tree in the month of February. The ſap being here carried to the germs or buds, is more concocted; and here having unfolded the leaves, theſe come to ſerve as lungs for the circulation and farther preparation of the juice. By ſuch means is the ſap ſtill farther altered and digeſted, as it is farther in the petals or leaves of the flowers, which tranſmit the juice, now brought to a farther ſubtility, to the ſtamina; theſe communicate it to the farina, or duſt, in the apices, which is, as it were, the male ſeed of the plant; where having undergone a farther maturation, it is ſhed into the piſtil, which performs the office of an uterus or womb; and thus having acquired its laſt perfection, it gives riſe to a new fruit or plant. The ſap having thus gone its ſtage, from the root to the remote branches, and even the flower; and having, in every part of its progreſs depoſited ſomething both for aliment and defence, what is redundant paſſes out into the bark, the veſſels of which are inoſculated with thoſe in which the ſap mounts; and through which it deſcends to the root, and thence to the earth again. And thus a circulation is effected.

SAP, or SAPP, in the art of war, is the digging deep under the earth of the glacis, in order to open a covered paſſage into the moat. It is only a deep trench, covered at top with boards, hurdles, earth, ſand-bags, &c. and is uſually begun five or ſix fathoms from the ſalliant angle of the glacis.

SAPATA, or ZOPATA. See the article ZOPATA.

SAPINDUS, the SOAPBERRY-TREE, in botany, a plant the flower of which conſiſts of four oval petals; and the fruit of three capſules, each including a globoſe nut.

The berries of this tree are uſed for waſhing, inſtead of ſoap, whence the Engliſh name.

SAPO, SOAP. See the article SOAP.

SAPONARIA, SOAPWORT, in botany, a plant the flower of which conſiſts of five petals, with a plane limb; and its fruit an unilocular capſule, containing a number of ſmall ſeeds.

The root of this plant is accounted aperient, corroborant, and ſudorific; and even preferred by ſome to ſaſſafras in theſe intentions. The leaves, agitated with water, raiſe a ſaponaceous froth, which has nearly the ſame effects with ſolutions of ſoap itſelf, in taking out ſpots from cloths, whence the name.

SAPPHIRE, a pellucid gem, which, in its fineſt ſtate, is extremely beautiful and valuable, and ſecond only to the diamond in luſtre, hardneſs, and price. Its proper colour is a pure blue; in the fineſt ſpecimens it is of the deepeſt azure, and in others varies into paleneſs in ſhades of all degrees between that and a pure cryſtal brightneſs and water, without the leaſt tinge of colour, but with a luſtre much ſuperior to the cryſtal. They are diſtinguiſhed into four ſorts, viz. the blue ſapphire, the white ſapphire, the water ſapphire, and the milk ſapphire.

The gem known to us by this name is extremely different from the ſapphire of the ancients, which was only a ſemi-opake ſtone, of a deep blue veined with white, and ſpotted with ſmall gold-coloured ſpangles, in the form of ſtars, and was only a more beautiful kind of the lapis lazuli: but our ſapphire they have deſcribed under the name of beryllus aeroides, or the ſky-blue beryl.

The fineſt ſapphires in the world are brought from the kingdom of Pegu, in the Eaſt-Indies, where ſome are found perfectly colourleſs, and others of all the ſhades of blue; theſe are all found in the pebble-form. We have very fine ſapphires alſo, partly pebble, partly cryſtal-ſhaped, from Biſnagar, Conanor, Calicut, and the iſland of Ceylon: theſe alſo are of all the ſhades of blue. And in Ceylon there are ſometimes found a ſort of baſtard gems, of a mixed nature between the ſapphire and ruby. The occidental are from Sileſia, Bohemia, and many other parts of Europe; but though theſe are often very

very beautiful ſtones, they are greatly inferior, both in luſtre and hardneſs, to the oriental.

The ſapphire is ſaid to have very great virtues as a cordial, ſudorific, and alexipharmic; but we have no good teſtimony of any body's having ever found this by experiment.

SAPPHIRINE WATER, in the materia medica, alſo called blue eye water, is thus prepared: pour a pint of lime-water, made ſtrong and freſh, into a copper-veſſel; add to it a dram of crude ſal armoniac, and throw in ſome filings or ſmall pieces of copper, and let it ſtand till it has acquired a beautiful colour.

This is uſed an an eye-water; as alſo to deterge old ulcers: and ſometimes it is mixed with other things in injections in gonorrhœas.

SARABAITES, a ſort of monks among the ancient chriſtians, who did not reſort to the wilderneſs as others did, but lived publicly in cities. Two or three of them uſually dwelt together, but they had no rule or government: they however obſerved very ſtrict faſts; wore looſe ſleeves, wide ſtockings, coarſe cloaths, frequently ſighed, and always bitterly inveighed againſt the clergy.

SARABAND, a muſical compoſition in triple time, the motions of which are ſlow and ſerious.

Saraband is alſo a dance to the ſame meaſure, which uſually terminates when the hand that beats riſes; by which it is diſtinguiſhed from a courant, which ends when the hand that beats the time falls; and is otherwiſe much the ſame as the minuet.

The ſaraband is ſaid to be originally derived from the Saracens, and is uſually danced to the ſound of the guitar or caſtanettes.

SARCASM, in rhetoric, a keen bitter expreſſion which has the true point of ſatyr, by which the orator ſcoffs and inſults his enemy: ſuch was that of the Jews to our Saviour, "He ſaved others, himſelf he cannot ſave."

SARCOCELE, in ſurgery, a ſpurious rupture, or hernia, wherein the teſticle is conſiderably tumified or indurated, like a ſchirrhus, or much enlarged by a fleſhy excreſcence, which is frequently attended with acute pains, and ſometimes ulceration, ſo as to degenerate at laſt into a cancerous diſpoſition. See HERNIA.

When the tumour of the teſticle is accompanied with hardneſs, the cauſes are much the ſame with thoſe of a ſchirrhus. When there is a fleſhy excreſcence, then the cauſe is uſually ſome contuſion or other external violence. The tumour differs as to its magnitude, being frequently no larger than an hen's egg, though ſometimes as big as a man's fiſt.

The ſigns whereby the ſarcocele may be diſtinguiſhed from other ruptures are principally the hardneſs of the tumour, and its ſeat being in the teſticle; whereas the true herniæ are diſtinct from the teſticle, and ſofter to the touch. If a ſarcocele be not timely brought to a ſuppuration, it very eaſily degenerates into a cancer; and if both teſticles are affected, caſtration is often neceſſary; but if the tumour proceeds through the inguen, up to the abdomen, even caſtration will be uſeleſs, and death is the conſequence.

A recent ſarcocele, according to Heiſter, may frequently be ſuppurated by digeſtive medicines, as well internal as external. When theſe medicines prove ineffectual, the ſize and pain of the tumour increaſe, and it ſeems inclined towards a cancerous diſpoſition, if it has not reached the ring of the abdominal muſcles, there is then but one way left of relieving the patient, and that is by a dexterous and timely extirpation of the diſordered teſticle, or both, if they are affected, which is termed caſtration, and renders the patient impotent.

In this operation the ſpermatic veſſels are firſt to be tied ſecurely with a ligature near the inguen, and afterwards divided, to give the patient leſs pain; and as a diviſion of theſe veſſels, which are ſo much enlarged, may be attended with a fatal hæmorrhage, it may be prudent, for the greater ſecurity, to paſs a double ligature round thoſe veſſels, one below the other; or elſe not to extirpate the teſticle ſo ſoon as it is freed from the ſcrotum, and its veſſels ſtrictly tied, but to wait a few days, till the teſticle begins to grow flaccid and mortifies, which is a ſign the ſpermatic veſſels are well ſecured, and may be divided without any danger; but if that does not follow, the ligature is not ſtrict enough, and another muſt be made, much tighter.

If a patient ſhould be troubled with a fleſhy excreſcence upon his teſticle, which is in other reſpects ſound, and finds no relief from medicines, the teſticle may be preſerved, and yet the patient freed from his diſorder, by opening the ſcrotum, and extirpating the offending part only.

With regard to the dreſſing, it is to be done with ſcraped lint and compreſſes, and ſecured by a proper bandage; and to abate the inflammation, which ſometimes ariſes, a diſcutient cataplaſm may be uſed, and the wound afterwards treated with ſome digeſtive ointment or vulnerary balſam. See WOUND.

SARCOCOLLA, in pharmacy, a gum-reſin, which approaches greatly to the nature of the ſimple gums.

It is brought to us from Perſia and Arabia, in ſmall granules, moderately heavy, and of a whitiſh, browniſh, or reddiſh colour, very friable, of a faintiſh diſagreeable ſmell, and of an acrid and nauſeous taſte.

Hoffman abſolutely condemns the internal uſe of it. However, it is recommended in ophthalmias, and defluxions of a ſharp matter upon the eyes; and is generally ordered to be diſſolved in milk for this purpoſe.

SARCOLOGY is that part of anatomy which treats of the ſoft parts, viz. the muſcles, inteſtines, arteries, veins, nerves, and fat. See the articles MUSCLE, INTESTINES, &c.

SARCOMA, in ſurgery, denotes any fleſhy excreſcence. See EXCRESCENCE.

Sarcomata of the noſe, eyes, &c. may be ſometimes removed by cauſtics; but the extirpating them with the knife or ſciſſars is the ſafeſt and moſt eligible method. The wound ſhould be ſuffered to bleed a while, after which it may be waſhed with a collyrium made of aloes, tutty, and ſugar of lead, mixed in roſe-water.

SARCOPHAGOUS MEDICINES, in ſurgery, &c. are thoſe which eat away proud fleſh, and otherwiſe called cauſtics.

SARCOTICS, in ſurgery, medicines which generate fleſh in wounds.

SARCULATION, in the antient agriculture, a kind of hoeing, uſed to root up the weeds in their peas, &c.

SARDA, the PILCHARD, in ichthyology. See PILCHARD.

SARDA, the CARNELIAN, in natural hiſtory. See CARNELIAN.

SARDACHATES, a beautiful ſpecies of agat, of a cloudy and ſpotted fleſh-colour. See AGAT.

SARDONYX, in natural hiſtory, a genus of ſemipellucid gems, of the onyx ſtructure, zoned or tabulated, and compoſed of the matter of the onyx variegated with that of the red or yellow carnelian. See CARNELIAN and ONYX.

Of this ſtone there are ſeveral beautiful ſpecies; as, 1. The thin zoned red ſardonyx, or whiteiſh onyx with thin ſnow-white and red zones. 2. The broad zoned red ſardonyx; or horny onyx, with punctuated zones. 3. The horny onyx, with whitiſh and yellow zones; and is properly the yellow ſardonyx, and the chryſolite onyx of the antients. 4. The orange-coloured ſardonyx; or bluiſh white onyx, with orange-coloured and whitiſh zones.

SARPLAR *of Wool*, the ſame with a pocket or half a ſack.

SARRASIN, or SARRAZIN, in fortification, the ſame with herſe. See HERSE.

SARRITION, in the antient huſbandry, the ſame with what we call hoeing.

SARSAPARILLA, the root of a ſpecies of bindweed, growing in the Spaniſh Weſt-Indies, and ſcarcely bearing the winters of our climate without ſhelter. The root conſiſts of a number of ſtrings, of great length, about the thickneſs of a gooſe-quill or thicker, flexible, free from knots, compoſed of fibres running their whole length, ſo that they may be ſtript in pieces from one end to the other. They are covered with a thin, browniſh, or yellowiſh aſh-coloured ſkin, under which lies a thicker

thicker white friable ſubſtance, and in the middle runs a woody pith.

This root has a farinaceous ſomewhat bitteriſh taſte, and no ſmell. To water it communicates a reddiſh brown, to rectified ſpirit a yellowiſh red tincture, but gives no conſiderable taſte to either menſtruum. An extract, obtained by inſpiſſating the ſpirituous tincture, has a weak, ſomewhat nauſeous, balſamic bitteriſhneſs, which is followed by a ſlight but durable pungency: the watery extract is much weaker, and in larger quantity.

Sarſaparilla was firſt brought into Europe by the Spaniards, about the year 1563, with the character of a ſpecific for the cure of the lues venerea, which made its appearance a little before that time. Whatever good effects it might have produced in the warmer climates, it was found to be inſufficient in this, inſomuch that many have denied it to have any virtue at all, and ſuppoſed that it could do no more, than by its farinaceous ſoftneſs to obtund the force of the gaſtric fluid, and thus weaken the appetite and digeſtion. It appears however, from experience, that though greatly unequal to the character which it bore at firſt, yet, in many caſes, ſtrong decoctions of it, drank plentifully and duly continued, are of very conſiderable ſervice, for promoting perſpiration, and what is called ſweetening or purifying the blood and humours. In the Medical Obſervations publiſhed by a ſociety of phyſicians in London, there are ſeveral inſtances of its efficacy in venereal maladies, as an aſſiſtant to mercury, or when mercury had preceded its uſe: it oftentimes anſwered, and that ſpeedily, after mercurial unctions, and long continued courſes of ſtrong decoctions of guaiacum, had failed. Dr. Harris ſays that infants who have received the infection from the nurſe, though full of puſtules and ulcers, and ſometimes troubled with nocturnal pains, are cured by ſarſaparilla without mercurials: he directs the powder of the root to be mixed with the food.

SARTORIUS, in anatomy, is both an abductor and elevator, ſerving to move the legs upwards and forwards, determining them to croſs each other, as taylors ſit with them, whence the name; it riſes from the internal part of the anterior and ſuperior ſpine of the ileum; and deſcending obliquely, is inſerted into the upper and inner part of the tibia.

SASSAFRAS, in pharmacy, the wood of an American tree, of the laurel-kind, imported in large ſtraight blocks: it is warm, aperient, and corroborant; and frequently employed, with good ſucceſs, for purifying and ſweetening the blood and juices; for which purpoſe an infuſion, in the way of tea, is a very pleaſant drink: its oil is very fragrant, and poſſeſſes moſt of the virtues of the wood.

It is an excellent diuretic and diaphoretic, and therefore good in obſtructions of the viſcera, cachexies, ſcorbutic complaints, and in the venereal diſeaſe.

SATELLITE, in aſtronomy, the ſame with a ſecondary planet, or moon; ſo called from its continually waiting upon or revolving round one of the primary planets. See PLANET.

Thus the moon may be called the ſatellite of the earth: but the term is chiefly applied to the new-diſcovered planets, which make their revolution about Saturn and Jupiter.

SATIR, SATIRE, or SATYR. See the article SATYR.

SATISFACTION, in law, is the giving a recompence for ſome injury done; or the payment of money due on bond, judgment, &c.

SATRAPA, or SATRAPES, in Perſian antiquity, denotes an admiral; but more commonly the governor of a province.

SATTIN, a gloſſy kind of ſilk-ſtuff, the warp of which is very fine, and ſtands out ſo as to cover the coarſer woof.

Some ſattins are quite plain, others wrought; ſome flowered with gold or ſilver, and others ſtriped, &c.

The Chineſe ſattins are moſt valued, becauſe of their cleaning and bleaching eaſily, without loſing any thing of their luſtre: in other reſpects they are inferior to thoſe of Europe.

SATTINET, a ſlight thin kind of ſattin, commonly ſtriped, and chiefly uſed by the ladies for ſummer night-gowns.

SATURATION, in chemiſtry, is the impregnating an acid with an alkali, or *vice verſa*, till either will receive no more, and the mixture become neutral.

SATURDAY, the ſeventh or laſt day of the week, ſo called from the idol Seater, worſhipped on this day by the ancient Saxons, and thought to be the ſame as the Saturn of the Latins. Saturday anſwers to the Jewiſh Sabbath. See SABBATH.

SATUREIA, SAVORY, in botany, a genus of plants, with a monopetalous ringent flower, and no pericarpium; the ſeeds, which are four and roundiſh, being contained in the bottom of the cup.

The leaves of ſummer-ſavory are very pungent, warm, and aromatic; and afford, in diſtillation with water, a ſubtile eſſential oil. Both are eſteemed good in crudities of the ſtomach, aſthmas, and menſtrual obſtructions.

SATURN, ♄, in aſtronomy, the remoteſt of the ſuperior planets, which, by reaſon of its great diſtance from the ſun, ſhines but with a feeble light. See PLANET.

Though Galileo's teleſcope was ſufficient to diſcover all Jupiter's moons, it could not reach Saturn's, on account of their great diſtance; but yet this ſagacious obſerver found Saturn, by reaſon of his ring, had a very odd appearance; for his glaſs was not good enough to exhibit the true ſhape of the ring, but only a confuſed idea of that and Saturn together, which in the year 1610, he advertiſed in the letters of this ſentence tranſpoſed: "Altiſſimum planetam tergeminum obſervavi;" i. e. I have obſerved Saturn to have three bodies.

This odd phœnomenon perplexed the aſtronomers very much, and various hypotheſes were formed to ſolve it; all which appeared trifling to the happy Huygenius, who applied himſelf purpoſely to improve the grinding of glaſſes, and perfecting long teleſcopes, to arrive at a more accurate notion of this planet and its appendage. Accordingly, in 1655, he conſtructed a teleſcope of twelve feet; and viewing Saturn divers times, he diſcovered ſomething like a ring encompaſſing his body; which afterwards, with a tube of twenty-three feet, he obſerved more diſtinctly, and alſo diſcovered a ſatellite revolving about the planet. This Huygenian ſatellite is the fourth in order from Saturn. See plate CI. *fig.* 3.

In the year 1659, Huygens publiſhed his diſcovery in relation to Saturn's ring, in the letters of this ſentence tranſpoſed: "Annulo cingitur tenui plano, nuſquam cohærente, ad eclipticam inclinato;" i. e. Saturn is encompaſſed by a thin plane ring, no where cohering to his body, and inclined to the plane of the ecliptic. This inclination of the ring to the ecliptic is determined to be about 31 degrees by Huygens, Romer, Pickard, Campans, &c. though by a method not very definitive. However, ſince the plane of the ring is inclined to the plane of the earth's motion, it is evident, when Saturn is ſo ſituated that the plane of his ring paſſeth through the earth, we can then ſee nothing of it; nor can we ſee it when the plane paſſes between the ſun and the earth, the dark ſide being then turned to us, and only a dark liſt appearing upon the planet, which is probably the ſhadow of the ring. In other ſituations the ring will appear elliptical, more or leſs; when it is moſt ſo, the heavens appear through the ecliptic ſpace on each ſide Saturn (which are called the anſæ), and a fixed ſtar was once obſerved by Dr. Clarke's father in one of them.

The nodes of the ring are in 19° 45′ of Virgo and Piſces. During Saturn's heliocentric motion from 19° 45′ to the oppoſite node, the ſun enlightens the northern plane of the ring.

Since Saturn deſcribes about one degree in a month, the ring will be viſible through a good teleſcope till within about fifteen or twenty days before and after the planet is in 19° 45′ of Virgo or Piſces. The time therefore may be found by an ephemeris, in which Saturn, ſeen from the earth, ſhall be in thoſe points of the ecliptic; and likewiſe when he will be ſeen from the earth in 19° 45′ of Gemini and Sagittarius, when the ring will be moſt open, and in the beſt poſition to be viewed.

There have been ſome grounds to conjecture that Saturn's ring turns round an axis; but that is not yet demonſtrable. This wonderful ring, in ſome ſituations, does alſo appear double; for Caſſini, in 1675, obſerved it to be diſſected quite round by a dark elliptical line, dividing it, as it were, in two rings, of which the inner one appeared brighter than the other. This was oftentimes obſerved afterwards, with tubes of thirty-four and twenty feet, and more evidently in the twilight or moonlight, than in a darker ſky. This ring is the moſt remarkable thing in the whole planetary ſyſtem, there being nothing of that nature hitherto diſcovered in any of the other planets. Kepler, in his Epitom. Aſtron. Copernic. and after him Dr. Halley, in his enquiry into the cauſes of variation of the needle, Philoſ. Tranſact. n° 195, ſuppoſe our earth may be compoſed of ſeveral cruſts or ſhells, one within another, and concentric to each other. And if ſo, then it is poſſible the ring of Saturn may be the fragment or remaining ruins of his formerly exterior ſhell, the reſt of which is broken or fallen down upon the body of the planet. And if Saturn ever had ſuch a ſhell round it, its diameter would then have appeared as big to an eye at the ſun, as that of Jupiter doth now, when ſeen from thence.

Since the outward margin of the ring is diſtant from Saturn 2 ' of Saturn's ſemi-diameter, this cannot be ſeen at the diſtance of 64 degrees from Saturn's equator, in whoſe plane the ring is placed. Therefore, a ſpectator, placed in a latitude higher than that, can never ſee the ring at all; ſo that there is a zone of almoſt 53 degrees broad towards either pole, to whom this famous ring can never appear. And as the ſpectator ſhall move nearer the pole, firſt one, then the ſecond ſatellite, next the third and fourth, and, when he is come within one degree of the pole, even the fifth ſatellite cannot be ſeen, unleſs by refraction; and, in the winter-time, neither ſun, moon, nor any planet will be there viſible, unleſs perhaps a comet.

If the eye be ſuppoſed to be placed in the equator of Saturn, or in the zone nearly adjoining, it can never ſee thoſe ſtars that are in or very near the equator, nor any one of the ſatellites; becauſe the ring will always hide them; and then at the equinoxes it cannot ſee the ſun; and if it were any where elſe placed, it could not then ſee the ring; becauſe neither of its faces will then appear illuminated by the ſun. The breadth of this ring it is hard to determine from our earth, becauſe its thickneſs is ſo ſmall; but Mr. Huygens makes it to be about 600 German miles.

For one half of Saturn's year (viz. fifteen of ours) only one face of the ring will be enlightened by the ſun; whence the inhabitants, which may be ſuppoſed to live in that hemiſphere, to which this face of the ring is turned, or to whom it is ſummer, will ſee that part of the ring which is above their horizon, ſhining faintly by day, as our moon doth when the ſun is above our horizon, but brighter and ſtronger by night, as our moon doth in the ſun's abſence; and, after ſun-ſet, the eaſtern part of this enlightened arch will fall within the ſhadow of Saturn; which ſhade will aſcend, as night comes on, and at night will be at the higheſt; and then will deſcend again towards the weſtern part of the ring, according as the ſun comes more and more to the eaſtward.

This enlightened arch will always ſhew how to deſcribe a meridian line; for a plane perpendicular to the horizon, and paſſing through the vertex of the arch, will be in the true meridian.

To an eye placed any where without, and at leſs than fifty degrees diſtant from the equator, this enlightened arch of the ring will appear concave as well as convex, like a kind of furnace or vault, riſing above the horizon: but to an eye more than 52 minutes, and leſs than 64 degrees, diſtant from the equator, the hollow or concave part will not be viſible; but there will appear a brightiſh body ariſing, as it were, out of the ground, and contiguous to the horizon.

For the other half of Saturn's year, while the ſun declines towards the depreſſed pole, or during the fifteen years winter, the ring will not be viſible, as having not that face illuminated which is turned to the ſpectator's eye; but, however, will render itſelf ſenſible, by covering from the ſight ſuch ſtars and parts of the heavens as are oppoſite to it, or apparently behind it. The ſhade of the ring alſo will be extended more and more towards the nearer pole; ſo that to an eye placed any where within the aforeſaid ſpace, the ſun, when he attains ſuch a certain declination, will appear to be covered or eclipſed juſt at noon, and then ſtraight to emerge out of the ſhadow. The next day, the like phænomenon will happen, but the eclipſe will begin ſooner, and will be over later: and theſe meridian eclipſes will daily increaſe in their duration until the middle of winter; and then they will decreaſe again gradually, till at laſt they will come to nothing again, viz. when the ſun, returning from the tropic, hath the ſame declination as he had when theſe meridional eclipſes began.

And this will happen, if an eye be placed in any latitude greater than 25 or 26 degrees; but if in a latitude leſs than this, when the meridional darkneſs is of the greateſt duration, the ſun will ſuddenly appear juſt in the meridian, and then ſtraightway will be eclipſed again. The next day there will appear the like ſort of light, but it will laſt longer; and this meridian light will grow ſtill longer and longer in duration, till mid-winter, and then, like the darkneſs above mentioned, it will be continually decreaſing, until it quite diſappear.

And from hence it is plain, that there is the greateſt difference between ſummer and winter in the globe of Saturn, of all the other planets; and this both on the account of the long duration of each, and the great declination of the ſun from the equator; and alſo by reaſon of theſe meridional darkneſſes of the winter, ariſing from the ring's eclipſing the ſun.

If an eye were placed in Saturn, the diameter of the ſun would appear almoſt ten times leſs than it doth to us; and conſequently his diſc, light, and heat, will be there ninety times leſs. Saturn's year is almoſt thirty of ours; but the length of his day is yet uncertain, becauſe the time of his revolution round his axis is not yet known; but Mr. Huygens judges they are longer than the days of Jupiter. That great aſtronomer ſuppoſeth the axis of Saturn to be perpendicular to the plane of his ring, and of the orbits of the ſatellites; if ſo, then there will be the ſame poſition of the equator and poles, as to the fixed ſtars, as there is in our earth; the ſame pole-ſtar and the fixed ſtars will appear to riſe and ſet after the ſame manner, in the ſame latitudes. There is a vaſt inequality in the length of the day, in ſeveral parts of this planet; and as great a diverſity of ſummer and winter; which depends on the quantity of the inclination of the plane of the equator to the plane of the orbit of Saturn round the ſun, which Huygens makes to be 51 degrees, which is almoſt one third more than our earth, where yet the differences and variety of ſeaſons and weather are very ſenſible. For in Saturn, in the latitude of 50 degrees, the longeſt day will have no night at all, and the longeſt night will have no day. And the two frigid zones will be each of them 62 degrees broad, at leaſt ten times as large as the whole ſurface of our earth. The eye thus placed will be able to diſcern none of the planets but Jupiter, which will appear always to accompany the ſun, and never to be from him above 37 degrees. The parallax of the ſun in Saturn is but nine ſeconds, and therefore inſenſible; but the parallaxes of all his moons or ſatellites are very conſiderable, and therefore their diſtances from him will be eaſily computable.

Satellites of SATURN, are five moons; the firſt or inmoſt of which revolves about Saturn in one day, 21 hours, and eighteen minutes, at the diſtance of near two ſemi-diameters of the ring; the ſecond in two days, 17 hours, and 41 minutes, at the diſtance of $2\frac{2}{5}$ ſemi-diameters; the third, in four days, 12 hours, and 25 minutes, at the diſtance of $3\frac{2}{3}$ ſemi-diameters; the fourth in 15 days, 22 hours, and 41 minutes, at the diſtance of eight ſemi-diameters; and the fifth, in 70 days, 22 hours, and four minutes, at the diſtance of $23\frac{3}{10}$ ſemi-diameters of Saturn's ring.

In the beginning of the year 1665, the celebrated Mr. Huygens, as already obſerved, diſcovered the biggeſt of Saturn's ſatellites; the other four ſatellites of Saturn were all the diſcovery of Mr. Caſſini, the third and fifth in the years 1671, 1672, and 1673; but the firſt and ſecond were

were not discovered till the year 1684, by extraordinary telescopes of eighty, one hundred, one hundred and fifty, and two hundred feet in length.

SATURN, in chemistry, &c. an appellation given to lead. See LEAD.

SATURN, in heraldry, denotes the black colour, in blazoning the arms of sovereign princes.

SATURNALIA, in Roman antiquity, a festival observed about the middle of December, in honour of the god Saturn, whom Lucan introduces, giving an account of the ceremonies observed on this occasion thus: "During my whole reign, which lasts but for one week, no public business is done; there is nothing but drinking, singing, playing, creating imaginary kings, placing servants with their masters at table, &c. There shall be no disputes, reproaches, &c. but the rich and poor, masters and slaves, shall be equal, &c.

On this festival the Romans sacrificed bare-headed, contrary to their custom at other sacrifices.

SATURNINE, an appellation given to persons of a melancholy disposition, as being supposed under the influence of the planet Saturn.

SATYR, in the heathen mythology, a fabulous kind of demi-god, or rural deity, of the antient Romans, represented with goats feet, and sharp pricked-up ears. Some think the notion of these satyrs might have been derived from the monkies known at present under the same name.

SATYR or SATIRE, in matters of literature, a discourse or poem exposing the vices and follies of mankind.

The satyr of the Greeks differed from that of the Romans, as being a kind of interlude annexed to tragedy, with a view to remove from the audience too melancholy impressions. But satyr, as we now have it, is entirely Roman, if we may believe Quintilian, who says, "*Satira quidem tota, nostra est*;" or Horace, who styles Ennius the inventor of a poem unknown to the Grecians, meaning satyr, according to the opinion of all his interpreters. Scaliger however expresly denies it to be of Roman original; and there is reason, indeed, as we shall see hereafter, to understand these expressions of Quintilian and Horace with some abatement. Those that will not allow it to be derived from the Grecians, but entirely Roman, maintain that satyr should be writ with an *i*, not a *y*; and that it is not derived from *satyrus*, but *satur*: *satira* therefore is the same as *satura*, as *maximus* antiently *maxumus*.

When the Romans grew more polite, these kind of verses refined in proportion, but they retained still their jibes and banters, and kept so far to their first institution, as to make the follies of human life the object of their ridicule. From hence proceeded satyr, so called from the farrago and variety of matter it contained. It was improved likewise with music and dancing, which, considering its being carried on in dialogue, made it resemble somewhat of the dramatic kind; nor had the Romans any thing that came so near the drama as this did. Afterwards, when they had received both tragedy and comedy from the Grecians, they were so taken with the novelty, that satyr for some time lay neglected: but coming again into esteem, it was added as a kind of exodium to comedy. Thus things went on for some years till Ennius arose, endued with wit and true poetic fire, who observing how fond the people were of seeing the vices of mankind exposed upon the stage, thought a poem on the said subject, without the decoration of scenes and action, might have the same effect. Accordingly he attempted satyrs in the same form we now see them, only he did not confine himself to the hexameter, but made use of all sorts of measure. The remains we have of this poet are noble indications of the strength of his genius; and Horace and Virgil have shewn what opinion they had of his writings by borrowing so much from them. After Ennius succeeded Pacuvius; but his works are all lost, excepting some fragments, and those of uncertain authority. Next came Lucilius, of whom also we have some fragments remaining: but his excellencies and imperfections are very amply set forth by Horace, whose words we have no occasion to cite here.

It must be allowed however, that one species of satyr owes its perfection to Horace, as another does to Juvenal. A third kind was the Varronian or Menippean satyr, so called from Menippus, a cynic philosopher among the Grecians, whose doctrine Varro followed. It was a sort of medley, consisting of not only all kinds of verse, but of verse and prose mixed together; a specimen of which we have in Petronius's Satyricon. We have none of Varro's poetical works remaining, except some small fragments; which is the more to be lamented, considering the character Quintilian gives of him, that he was the most learned of all the Romans.

The word satyr was antiently taken in a less restrained sense than it is at present, not only as denoting a severe poem against vice, but as consisting of precepts of virtue, and the praises of it: and even in the satyrs, as they are called, of Horace, Juvenal, and Persius, &c. which are principally levelled against the weakness, the follies, or vices of mankind, we find many directions, as well as incitements, to virtue. Such strokes of morality Horace is full of; and in Juvenal they occur very frequently. All of them, sometimes, correct vice like moralists; we may say, like divines rather than satyrists.

With respect to the nature and different species of it, satyr, in general, being a poem designed to reprove the follies and vices of mankind, is twofold; either the jocose, as that of Horace; or the serious, like that of Juvenal: the former hidden, the latter open: that generally makes sport with vice, and exposes it to ridicule; this probes it to the bottom, and puts it to the torture: and so far is it from not deserving the title of satyr, as some pretend, that it seems rather a more noble species of it; and the genteel strokes of Horace, how ingenious soever, are less affecting than the poetic rage and commendable zeal of Juvenal.

They both agree in being pungent and cutting, yet are distinguished by very evident marks. The one is pleasant and facetious, the other angry and austere: the one smiles, the other storms: the foibles of mankind are the object of one; greater crimes of the other: the former is always in the pleasing style; the latter generally in the sublime: that abounds with wit only; this adds to the salt bitterness and acrimony. Either kind of satyr may be writ in the dialogue or epistolary manner; and we have instances of both forms in Horace, Juvenal, and Persius. As some of Horace's, which are called satyrs, are as truly epistles; so many of his epistles might as well be called satyrs: for example, *Qui fit Mecænas*, &c. might, with equal reason, be reckoned among the epistles; and *Prima dicta, mihi*, &c. among the discourses or satyrs; if the author or editor had so thought fit.

The chief satyrists among the antients are Horace, Juvenal, and Persius; those among the moderns, Regnier and Boileau in French; and Dryden, Oldham, Rochester, Buckingham, Pope, Young, &c. among the English.

SATYRIUM, GOAT'S-STONES, a genus of plants, the flower of which consists of five ovato-oblong petals; and its fruit is an oblong, unilocular capsule, containing a great many scobiform and very small seeds.

The root of this plant is composed of two oval bulbs, of a whitish colour, a sweetish taste, and a faint unpleasant smell; it abounds with a glutinous slimy juice; and, like other mucilaginous vegetables, it serves to thicken the thin serous humours, and defend the solids from their acrimony: it has also been celebrated, though on no very good foundation, for analeptic and aphrodisiac virtues; in which intentions it has also been frequently used.

SAUCISSE, or SAUSAGE, in the military art, a long train of powder, sewed up in a roll of pitched cloth, about two inches in diameter, serving to set fire to mines. See MINE.

There are usually two sauciſſes extended from the chamber of the mine to the place where the engineer stands; that in case one should fail, the other may take effect.

SAUCISSON, in fortification, a mass of large branches of trees bound together; and differing only from a fascine, as this is composed of small branches of twigs.

SAVIN, *Sabina*, in botany, a species of juniper, and famous as an hysteric and attenuant; and, indeed, it promotes

motes the diſcharges by urine, and the menſes, more forcibly than ſafely, if not under very careful management.

SAVIOUR, an appellation peculiarly given to Jeſus Chriſt, as being the true Meſſiah, and Saviour of the World.

Order of St SAVIOUR, a religious order in the Romiſh church, founded by St. Bridget, about the year 1345; and ſo called from its being pretended that our Saviour himſelf dictated to the foundreſs its conſtitutions and rules.

According to the conſtitutions, this order is principally founded for religious women who pay a particular honour to the holy virgin: but there are ſome monks of the order, to adminiſter the ſacraments and ſpiritual aſſiſtance to the nuns. The number of nuns is fixed at ſixty in each monaſtery; and that of the religious prieſts at thirteen, according to the number of the apoſtles, of whom St. Paul was the thirteenth. There are alſo four deacons, repreſenting the four doctors of the church, St. Ambroſe, St. Auguſtin, St. Gregory, and St. Jerom; and eight lay-brothers; who all together make up the number of the thirteen apoſtles, and the ſeventy-two diſciples of Jeſus Chriſt. The nuns are not admitted till eighteen years of age, nor the friars before twenty-five; and they are to perform a year's novitiate.

SAUNDERS, the ſame with ſantalum. See the article SANTALUM.

SAW, an inſtrument which ſerves to cut into pieces ſeveral ſolid matters; as wood, ſtone, ivory, &c.

The beſt ſaws are of tempered ſteel ground bright and ſmooth; thoſe of iron are only hammer-hardened: hence, the firſt, beſides their being ſtiffer, are likewiſe found ſmoother than the laſt. They are known to be well hammered by the ſtiff bending of the blade; and to be well and evenly ground, by their bending equally in a bow.

The edge, in which are the teeth, is always thicker than the back, becauſe the back is to follow the edge. The teeth are cut and ſharpened with a triangular file, the blade of the ſaw being firſt fixed in a whetting-block. After they have been filed the teeth are ſet, that is, turned out of the right line, that they may make the kerf or fiſſure the wider, that the back may follow the better. The teeth are always ſet ranker for coarſe cheap ſtuff than for hard and fine, becauſe the ranker the teeth are ſet the more ſtuff is loſt in the kerf. The ſaws by which marble, and other ſtones are cut, have no teeth: theſe are generally very large, and are ſtretched out and held even by a frame.

The workmen who make the greateſt uſe of the ſaw, are the ſawyers, carpenters, joiners, cabinet-makers, eboniſts, ſtone-cutters, carvers, ſculptors, &c. The lapidaries too have their ſaw, as well as the workers in moſaic; but theſe bear little reſemblance to the common-ſaw. But of all mechanics, none have ſo many ſaws as the joiners; the chief are as follows; the pit-ſaw, which is a large two-handed ſaw, uſed to ſaw timber in pits; this is chiefly uſed by the ſawyers. The whip-ſaw, which is alſo two handed, uſed in ſawing ſuch large pieces of ſtuff as the hand-ſaw will not eaſily reach. The hand-ſaw, which is made for a ſingle man's uſe, of which there are various kinds; as the bow or frame-ſaw, which is furniſhed with cheeks: by the twiſted cords which paſs from the upper parts of theſe cheeks and the tongue in the middle of them, the upper ends are drawn cloſer together, and the lower ſet further apart. The tenon-ſaw, which being very thin, has a back to keep it from bending. The compaſs ſaw, which is very ſmall, and its teeth uſually not ſet: its uſe is to cut a round, or any other compaſs-kerf: hence the edge is made broad and the back thin, that it may have a compaſs to turn in.

The ſurgeons alſo uſe a ſaw to cut off bones; this ſhould be very ſmall and light, in order to be managed with the greater eaſe and freedom, the blade exceeding fine, and the teeth exquiſitely ſharpened, to make its way more gently, and yet with great expedition, in cutting off legs, arms, &c.

SAW-FISH, in ichthyology, a ſpecies of ſqualus, with the roſtrum very long, flat, and dentated on both ſides. It is one of the moſt ſingular animals of the fiſh kind, and grows to a conſiderable ſize, being often more than twelve feet in length, including the roſtrum, and very thick in proportion: the head is large, and terminates in a bony roſtrum, three or four feet, or more, in length, and furniſhed all along, on both ſides, with very long, robuſt, and ſharp teeth, or denticulations.

SAWING, dividing timber, &c. by the application of a ſaw, either by the hand or mill.

The mechaniſm of a ſawing mill may be reduced to three principal things; the firſt, that the ſaw be drawn up and down as long as is neceſſary, by a motion communicated by water to the wheel: the ſecond, that the piece of timber to be cut into boards be advanced by an uniform motion to receive the ſtrokes of the ſaw; for here the wood is to meet the ſaw, and not the ſaw to follow the wood; therefore the motion of the wood and that of the ſaw ought immediately to depend the one on the other: the third, that when the ſaw has cut through the whole length of the piece, the whole machine ſtops of itſelf, and remains immoveable; for fear, leſt having no obſtacle to ſurmount, the force of the water ſhould turn the wheel with too great rapidity, and break ſome part of the machine. In plate CXI. we have given ſeveral views of this mill: *fig.* 1. repreſents a ſection of it taken lengthwiſe from A to B.

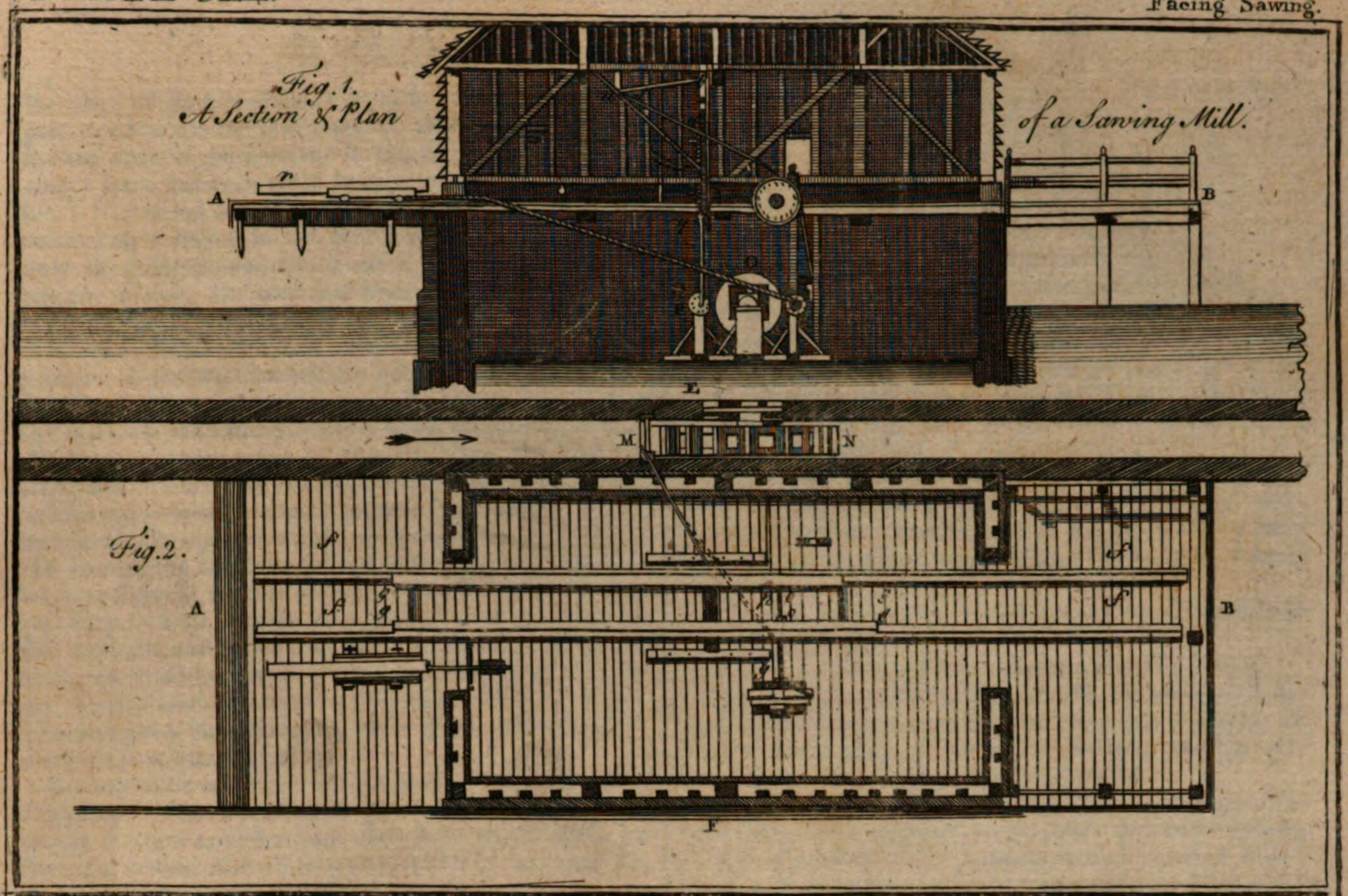
Fig. 2. ibid. is a plan of the mill on a level with the ground: A B being the floor, and *f f*, *g g*, two grooves for receiving the ſhafts of the chariot, which carries the piece to be ſawed; by which means the piece not only advances with the chariot, but is alſo kept ſteady, ſo that the ſtrokes of the ſaw work always on the ſame line.

Fig. 3. repreſents the breadth of the mill: and *fig.* 4. ibid. the plan of the cave of the mill. In each of theſe figures the ſame letters expreſs the ſame parts, only repreſented in a different view: thus M N, in *fig.* 1. and 3. ibid. repreſent the great wheel turned by a fall of the water, which has five feet and a quarter of radius, and its arbor is ſixteen inches. O, in each of the figures, is the cog wheel turning on the ſame arbor with the great wheel, and inſerting its teeth into the ſpindles of the trundle-head P; and, on the other, into thoſe of the trundle-head R: in the trundle-head P there is a broad crank faſtened to the iron-blade *y*, (plate CXI. *fig.* 1.) which, as the trundle-head moves round, goes up and down, and gives the ſame motion to the ſaw T: this crank is ſeen in its true form at Q, (plate CXI. *fig.* 3. and 4.) The other trundle-head, R, which turns with its axle-tree, or roller, S, (ibid. *fig.* 4.) winds up a rope, which brings towards the ſaw the chariot *r*, (pl. CXI. *fig.* 1.) on which the piece of wood to be ſawed is placed. When the wood is arrived cloſe to the ſaw, the rope is no longer of uſe; there being then another moderator, which regulates the motion of the piece in proportion as it is ſawed. Z, (plate CXI. *fig.* 3.) is a cramp-wheel, containing three hundred and eighty-four hooked teeth, the axis of which wheel drives two ſmall trundle-heads, which are inſerted into teeth which line the undermoſt part of the ſhafts of the chariot; by which means, if the cramp-wheel advances, the chariot muſt alſo advance, and the piece of timber with it.

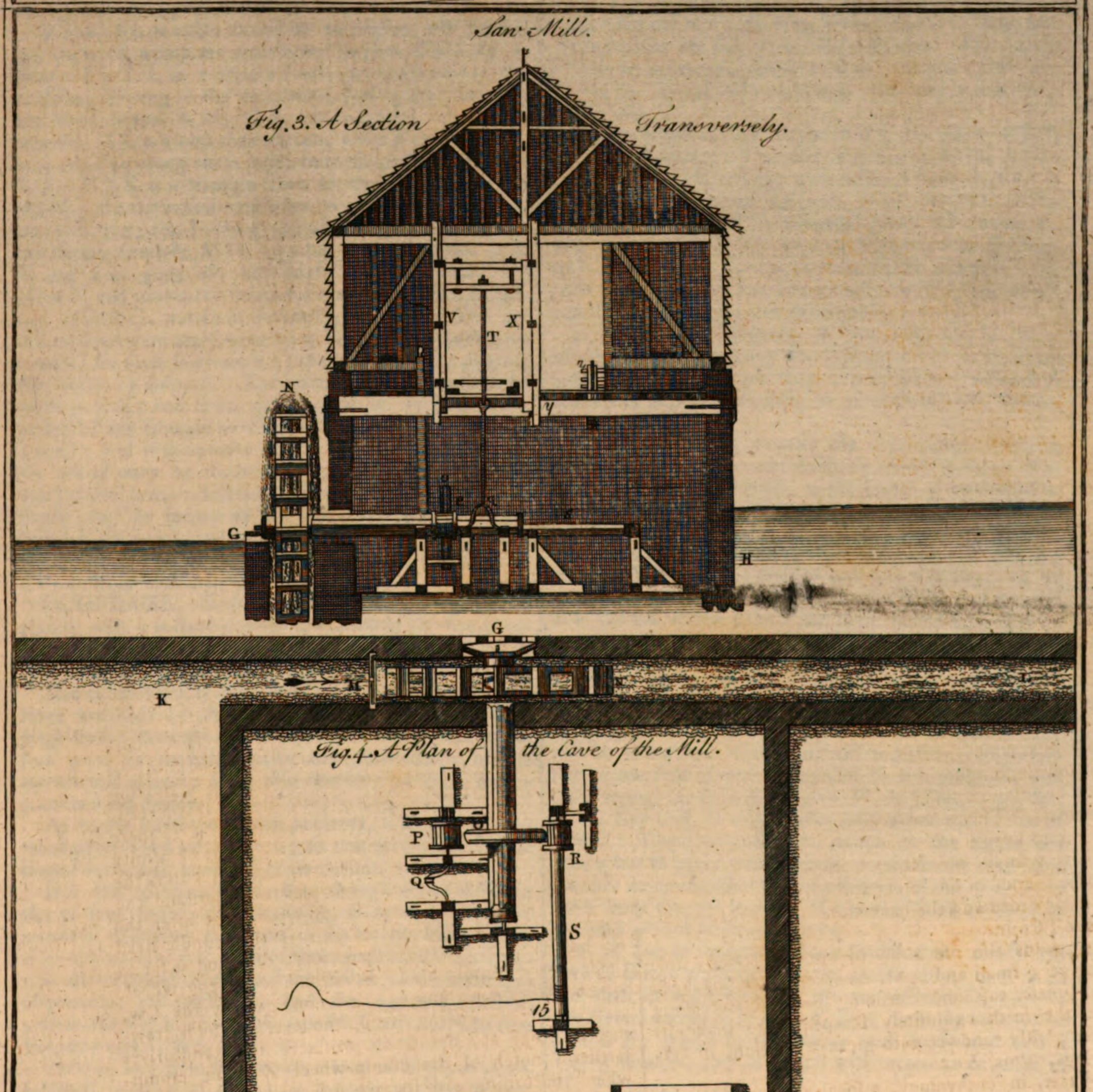
Upon the upper part of the entortiſe of the ſaw, (plate CXI. *fig.* 1.) there is an iron-rod, *b*, faſtened to it, on the one end with a hinge, and on the ſide to a moving lever, *d*, which goes up and down with it; this lever is faſtened by a hinge at *a*: from the end of this lever there deſcends a wooden ſhaft, which carries at its extremity an iron in the form of a hind's foot, which enters the teeth of the cramp-wheel. In order to underſtand the uſe of all theſe parts, let it be obſerved, that after the rope, by being wound on the axis of the trundle-head R, has brought the chariot and piece of wood as far as the ſaw, the trundle-head P is let looſe to the cog-wheel, which makes the crank Q, and conſequently the ſaw, go up; which aſcending lifts up the lever *d*, which drawing the hinge at *a* the handle protracts itſelf, and drives farther a notch of the cramp-wheel Z: this cramp-wheel, in turning with its axis, drives round the trundle-heads, which inſerting their trundles into the teeth at the bottom of the chariot, carry off ſome of them, and make

PLATE CXI.

Facing Sawing.



Saw Mill.



the piece of timber come a little forwards. This is all performed while the ſaw aſcends: and as it is larger at the top than at the bottom, it leaves at that inſtant an empty ſpace between itſelf and the piece of wood it has bit. The wood advances without any obſtacle, and receives a new ſtroke in the fall of the ſaw, which works only in going down; the wheel Z is at that time without any motion, and therefore communicates none to the chariot. It is during that reſt of the piece of wood that the ſtroke of the ſaw is given; and as the ſaw is broader at the top than at the bottom, it leans on the length of the wood, which is an ingenious imitation of the ſawyers, who bring the ſaw down obliquely, becauſe the fibres of wood are not eaſily cut when the ſtroke is tranſverſal: and as the arms of the ſaw move backwards and forwards occaſionally, to give the ſaw a proper inclination on the fibres of the wood; thus the upper iron rod, and the iron at the bottom of the ſaw obey the motion of the lever and crank, ſo as to form with the ſaw the inflexions neceſſary. This motion is continued, and the timber is ſtill brought under the ſaw, till a band of iron faſtened to the extremity of the piece of wood, meets with a trigger which draws out a pin applied to the ſluice to keep it up: when the ſluice falls the water ſtops, and the whole machine is without motion.

Sawing-mills are much uſed abroad, and were lately begun to be introduced in England; but the parliament taking it into conſideration that they would ſpoil the ſawyer's trade, and ruin great numbers of families, thought fit to ſuppreſs them.

Stones, &c. are alſo ſawed by an engine, the principal parts of which are repreſented in plate CXII. *fig.* 1. where I L L I, is a ſquare frame perpendicular to the horizon, moving in the direction L L, in gutters made in the fixed beams A M, C B, and running upon little wheels. I L are two rods of iron, and *o p* two hands of iron running along thoſe rods; to theſe are fixed the ſaws S, S. H I K is a triangle fixed to the axis of a great wheel. As the wheel and triangle go about from H towards I, the point I acting againſt the piece G, moves the frame towards M B, together with the ſaws S, S. When I is gone off, the angle K acts againſt the piece F, and moves the frame back again. Then H, acting againſt G, moves it forward; and ſo the ſaws are moved backward and forwards, as long as the wheel turns round. As theſe ſaws work by the motion of the engine, the hands *o p* deſcend. The parts F and G ought to be made curved; and little wheels may be applied at the points of the triangle to take away the friction againſt F and G: and if the power be ſtrong enough, the axle of the wheel may be made to carry more triangles, and work more ſaws. Inſtead of the triangle H I K, the frame may be moved by the two pieces *a b*, *c d*, going through the axis acroſs one another, ſo that *a b* may only act on F, and *c d* on G; F being only in the plane of *a b*'s motion, and G in that of *c d*.

SAXIFRAGE, *Saxifraga*, in botany, a genus of plants, with a roſaceous flower, conſiſting of five plane ovated petals: the fruit is an unilocular capſule, of an oval form, containing a great many ſeeds.

The tuberoſities at the root of the white-flowered ſaxifrage are kept in the ſhops under the name of ſaxifrage-ſeeds: they are diuretic and attenuant; and therefore good in nephritic caſes and obſtructions of the menſes and viſcera: ſome alſo recommend them in the jaundice and dropſy.

As to the ſaxifrage of the ancients, it is not known what plant they meant by it; ſo that no benefit can be reaped from their accounts of its virtues.

It is alſo to be obſerved, that though many different plants have been called ſaxifrage, from their ſuppoſed power of diſſolving the ſtone in the human bladder, yet it is very certain that none of them poſſeſs ſuch a virtue: thus the chryſoſplenium has been called golden-ſaxifrage; filipendula, red-ſaxifrage; and the common melilot, yellow-ſaxifrage. See the articles CHRYSOSPLENIUM FILIPENDULA, &c.

SAY or SAYE, in commerce, a kind of ſerge, or woollen-ſtuff, much uſed abroad for linings, and by the religious for ſhirts: with us it is uſed for aprons by ſeveral ſorts of artificers, being uſually dyed green.

SCABIOUS, *Scabioſa*, in botany, a plant with a floſculous flower, each floſcule being monopetalous and tubular, and ſlightly divided into four or five ſegments at the limb: there is no pericarpium; the ſeeds, which are ſingle after each floſcule, being crowned with their proper cups, and contained in the common receptacle.

The leaves of ſcabious ſtand recommended as aperient, ſudorific, and expectorant; but the preſent practice has little dependance on theſe virtues.

SCAFFOLD, among builders, an aſſemblage of planks and boards, ſuſtained by treſſels and pieces of wood fixed in the wall; whereon maſons, bricklayers, &c. ſtand to work in building high walls, &c. and plaſterers, in plaſtering ceilings, &c.

Scaffold alſo denotes a timber-work raiſed in the manner of an amphitheatre, for the more commodious viewing any ſhow or ceremony: it is alſo uſed for a little ſtage, raiſed in ſome public place whereon to behead criminals.

SCALA, in anatomy, a name given to two canals in the cochlea of the ear.

SCALA, in architecture, the ſame with ſtair-caſe.

SCALADO, or SCALADE, in the art of war, a furious aſſault made on the wall or rampart of a city, or other fortified place, by means of ladders, without carrying on works in form to ſecure the men.

SCALE, a mathematical inſtrument, conſiſting of ſeveral lines drawn on wood, braſs, ſilver, &c. and variouſly divided, according to the purpoſes it is intended to ſerve; whence it acquires various denominations, as the plain ſcale, diagonal-ſcale, plotting ſcale, Gunter's-ſcale, &c.

Conſtruction and Uſe of the Plain SCALE. The plain-ſcale is an inſtrument much uſed in navigation, &c. for ſolving the ſeveral caſes of ſailing. See the article NAVIGATION.

Having deſcribed the circle D B C A, (plate CXII. *fig.* 2.) and divided it into four quadrants, by the diameters A B and C D croſſing each other at right angles: 1. To project the line of tangents, from the end C of the diameter C D, erect the perpendicular C G; then dividing the arch C B into nine equal parts, from the center E, through the ſeveral diviſions of the quadrant C B, draw lines till they cut the perpendicular C G, which will thereby become a line of tangents.

2. For the ſemi-tangents, or half tangents, let lines be drawn from the point D, through the ſame diviſions upon the arch C B; and they will divide the radius B E into a line of ſemi-tangents, as is evident from Euclid. lib. 3. prop. 20.

3. For the ſecants, transfer the lines drawn from the center through the ſeveral diviſions of the quadrant C B to form the line of tangents, to the line E B continued to F, and the line E F will be a line of ſecants.

4. For the ſines, from the ſeveral diviſions of the quadrant C B, let fall perpendiculars upon the radius C E; which will thereby be divided into a line of ſines, to be numbered from E to C for the right ſines, and from C to E for the verſed ſines: and theſe verſed ſines may be continued to 180°, if the ſame diviſions be transferred on the other ſide of the center E.

5. For the chords: the arch C B being divided into nine equal parts, in the points 10, 20, 30, &c. if lines be imagined to be drawn from C to theſe diviſions, they will be the chords of their reſpective arches; wherefore ſetting one foot of your compaſſes in the point C, and transferring the ſeveral lengths, C 10, C 20, C 30, &c. to the line C B, it will thereby be divided into a line of chords. Theſe ſeveral lines, which in the figure are drawn but to every tenth degree, might in the very ſame manner be conſtructed to every degree, if the circle were made large enough to admit of ninety diſtinct diviſions in the arch of one of its quadrants.

6. A line of rhumbs is thus conſtructed: divide the arch D B into eight equal parts, in the points 1, 2, 3, 4, &c. then ſetting one foot of the compaſſes in D, transfer the ſeveral diſtances D 1, D 2, D 3, from the arch to the line D B; which by this means will be divided into a line of rhumbs, each of which will anſwer to an angle of 11° 15′.

7. To conſtruct a line of longitude, divide the radius E A into ſixty equal parts, marking every ten with their

proper numbers; from these divisions let fall perpendiculars upon the arch A D, and having drawn the line A D, with one foot of the compasses in A, transfer the several distances, where the perpendiculars cut the arch to the line A D, which will thereby be divided into a line of longitude.

8. To project the line of latitude, the radius C E being already divided into a line of sines, lay a ruler from the point B through each of the said divisions, and mark the points cut on the opposite arch A C with the numbers 10, 20, 30, &c. then having drawn the line A C, with one foot of your compasses in A, transfer the several intersections of the arch to the said line, which will thereby become a line of latitude.

9. To project the hour line, draw the tangent I K equal and parallel to the diameter CD, and divide half the arch of each quadrant A C, and A D, from the point A, into three equal parts, which will be 15° each part, for the degrees of every hour from twelve to six; each of which parts are to be again subdivided into halves and quarters, &c. then drawing lines from the center E, through each of their divisions and sub-divisions, till they cut the tangent I K, the said tangent will thereby be divided into a line of hours.

10. To the above lines may be added a line of inclination of meridians, which is projected in the same manner as the hour-line; being only divided into degrees, instead of time, every fifteen degrees being equal to an hour.

Now if these lines, with their respective divisions, be transferred to a scale, and there also be added a line of equal parts, the instrument called the plain scale will be compleated, as in *fig.* 3. and as to the uses of these lines, those of tangents, semi-tangents, and secants, serve to find the centers and poles of projected circles, in the stereographic projection of the sphere, &c. the line of sines serves for the orthographic projection of the sphere; the line of chords serves either to lay down any angle, or measure the quantity of one already laid down: the line of rhumbs serves with more readiness than the line of chords, to lay down or measure the angle of a ship's course in navigation: the line of longitude being laid down on the scale contiguous to a line of chords of the same radius, and numbered the contrary way, shews by inspection how many miles there are in a degree of longitude in each parallel of latitude; reckoning the latitude upon the line of chords, and the miles of longitude upon the line of longitude: the two lines of latitudes and hours are used conjointly, and serve very readily to mark the hour-lines in the construction of dials, on any kind of upright planes.

Diagonal-SCALE is projected thus: first draw eleven parallel lines at equal distances (see plate CXII. *fig.* 4.) the whole length of which being divided into a certain number of equal parts, according to the length of the scale, by perpendicular parallels, let the first division be again subdivided into ten equal parts, both above and below; then drawing the oblique lines from the first perpendicular below to the first sub-division above, and from the first sub-division below to the second sub-division above, &c. the first space shall thereby be exactly divided into one hundred equal parts; for as each of these sub-divisions is one tenth part of the whole first space or division, so each parallel above it is one tenth of such sub-division, and consequently one hundredth part of the whole first space; and if there be ten of the larger divisions, one thousandth part of the whole scale. If therefore the larger divisions be accounted units, the first subdivisions will be tenth parts of an unit; and the second sub-divisions, marked by the diagonals on the parallels, hundredth parts of an unit. Again, if the larger divisions be reckoned tens, the first sub-divisions will be units, and the second subdivisions tenth parts; and if the larger divisions be accounted hundredths, the first sub-divisions will be tens, and the second units: and so on.

Gunter's SCALE. See GUNTER'S *Scale*.

SCALE, *Scala*, in music, is a denomination given to the arrangement of the six syllables invented by Guido Aretine, *ut*, *re*, *mi*, *fa*, *sol*, *la*, called also gammut. See GAMMUT.

It bears the name scale (i. e. ladder) by reason it represents a kind of ladder, by means whereof, the voice rises to acute, or descends to grave; each of six syllables being, as it were, one step of the ladder. Scale is also used for a series of sounds rising or falling towards acuteness or gravity, from any given pitch of tune, to the greatest distance that is fit or practicable, through such intermediate degrees as make the succession most agreeable and perfect, and in which we have all the harmonical intervals most commodiously divided. See the article INTERVAL.

This scale is otherwise called an universal system, as including all the particular systems belonging to music. See SYSTEM.

Origin and Construction of the SCALE *of Music.* Every concord or harmonical interval is resolvible into a certain number of degrees or parts; the octave, for instance, into three great tones, two less tones, and two semi-tones; the greater sixth into two greater tones, one less tone, and two semi-tones; the fifth into two greater tones, one less tone, and one semi-tone; the fourth into one greater tone, one less tone, and one semi-tone; the greater third into one greater tone, and one less tone; and the lesser third into one greater tone and one less tone. It is true, there are variety of other intervals or degrees, besides greater tones, less tones, and semi-tones, into which the concords may be divided; but these three are preferred to all the rest, and these three alone are in use. Farther, it is not any order or progression of these degrees that will produce melody; a number, for instance, of greater tones, will make no music, because no number of them is equal to any concord, and the same is true of the other degrees; there is a necessity, therefore, of mixing the degrees to make music, and the mixture must be such, as that no two of the same kind be ever next each other. See the article CONCORD.

A natural and agreeable order of these degrees, Mr. Malcolm gives us in the following division of the interval of an octave, wherein (as all the lesser concords are contained in the greater) the divisions of all the other simple concords are contained. Under the series are the degrees between each term, and the next. In the first series, the progression is by the less third; in the latter, by the greater third.

Great 2d.	gr. 3d.	4th.	5th.	6th.	7th.	8th.
1 : 9/8 great tone. : 5/6 less tone. : 3/4 semi-tone. : 2/3 great tone. : 3/5 less tone. : 5/9 great tone. : 1/2 semi-tone.						
Key or fund.						

Great 2d.						
1 : 9/8 great tone. : 5/6 semi-tone. : 3/4 less tone. : 2/3 great tone. : 5/8 semi-tone. : 5/9 great tone. : 1/2 less tone.						
Key or fund.						

Now the system of octave containing all the original concord, and the compound concords being only the sums of the octave and some less concord; it is evident that, if we would have the series of degrees continued beyond an octave, there to be continued in the same order through a second as through the first octave; and so on through a third and a fourth octave, &c. and such a series is what we call the scale of music.

Of this there are two different species, according as the less or greater third, or the less or greater sixth are taken in; for both can never stand together in relation to the same key or fundamental, so as to make an harmonical scale. But, if by either of these ways, we ascend from a fundamental or given sound to an octave, the succession will be melodious, though the two make two different species of melody. Indeed, every note is discerned with regard to the next; but each of them is concord to the fundamental, except the second and seventh. In continuing the series there are two ways of compounding the names of the simple interval with the octave; thus a greater or lesser tone, or semi-tone, above an octave or two octaves, &c. or to call them by the number of degrees from the fundamental, as ninth, tenth, &c.

In

In the two ſcales above, the ſeveral terms of the ſcale are expreſſed, by the proportionable ſections of a line repreſented by 1. the key or fundamental of the ſeries. If we would have the ſeries expreſſed in whole numbers, they will ſtand as follows, in each whereof the greateſt number expreſſes the longeſt chord, and the other numbers the reſt in order; ſo that, if any number of chords be in theſe proportions of length, they will expreſs the true degrees and intervals of the ſcale of muſic, as contained in an octave concinnouſly divided in the two different ſpecies above-mentioned.

540 great tone.	: 480 leſs tone.	: 432 ſemi-tone.	: 405 great tone.	: 360 leſs tone.	: 324 great tone.	: 288 leſs tone.	: 270 ſemi. tone.	
216 great tone.	: 192 ſemi-tone.	: 180 leſs tone.	: 162 great tone.	: 144 ſemi-tone.	: 135 great tone.	: 120 leſs tone.	: 108 ſemi-tone.	

This ſcale the antients called the diatonic ſcale, becauſe proceeding by tones and ſemitones.

The moderns call it ſimply the ſcale, as being the only one now in uſe; and ſometimes the natural ſcale, becauſe its degrees and their order are the moſt agreeable and concinnous, and preferable, by the conſent both of ſenſe and reaſon, to all other directions ever inſtituted. Thoſe others are the chromatic and enharmonic ſcales, which, with the diatonic, made the three ſcales or genera of melody of the antients.

The deſign of the ſcale of muſic is to ſhew how a voice may riſe and fall leſs than any harmonical interval, and thereby move from one extreme of any interval, to the other, in the moſt agreeable ſucceſſion of ſounds. The ſcale, therefore, is a ſyſtem exhibiting the whole principles of muſic; which are either harmonical intervals (commonly called concords) or concinnous intervals. The firſt are the eſſential principles, the other ſubſervient to them, to make the greater variety.

Accordingly, in the ſcale we have all the concords with their concinnous degrees ſo placed, as to make the moſt perfect ſucceſſion of ſounds from any given fundamental or key, which is ſuppoſed to be repreſented by 1. It is not to be ſuppoſed that the voice is never to move up and down by any other more immediate diſtances than thoſe of the concinnous degrees; for though that be the moſt uſual movement, yet, to move by harmonical diſtances, as concords, at once, is not excluded, but is even abſolutely neceſſary. In effect, the degrees were only invented for variety's ſake, and that we might not always move up and down by harmonic intervals, tho' thoſe are the moſt perfect, the others deriving all their agreeableneſs from their ſubſerviency to them. See the article CONCORD.

Add, that beſides the harmonical and concinnous intervals, which are the immediate principles of muſic, and are directly applied in practice; there are other diſcord relations which happen unavoidably in muſic in a kind of accidental and indirect manner; for, in the ſucceſſion of the ſeveral notes of the ſcale, there are to be conſidered, not only the relations of theſe that ſucceed others immediately, but alſo of thoſe betwixt which other notes intervene. Now the immediate ſucceſſion may be conducted ſo as to produce good melody, and yet among the diſtant notes there may be very groſs diſcords that would not be allowed in immediate ſucceſſion, much leſs in conſonance. Thus, in the firſt ſeries or ſcale above delivered, though the progreſſion be melodious, as the terms refer to one common fundamental, yet are there ſeveral diſcords among the mutual relations of the terms; e. gr. from 4th to 7th is 32 : 45, and from the greater 2d to the greater 6th is 27 : 40, and from the greater 2d to 4th is 27 : 32, which are all diſcords; and the ſame will happen in the ſecond ſeries.

SCALE, in geography and architecture, a line divided into equal parts, placed at the bottom of a map, or plan, to ſerve as a common meaſure for all the parts of the building, or all the diſtances and places of the map.

SCALENE, or SCALENOUS TRIANGLE, *Scalenum*, in geometry, a triangle whoſe ſides and angles are unequal.

SCALENUS, in anatomy, a name given to one of the flexors of the neck. This muſcle has its origin from the firſt, ſecond, and ſometimes the third rib; and is inſerted into the apophyſes of the vertebræ of the neck, and is by ſome juſtly referred to the number of the elevators of the thorax. The ſcalenus is frequently divided into three parts; hence ſome anatomical writers have made three muſcles of it under the names of the firſt, the ſecond, and the third ſcalenus.

SCALPEL, in ſurgery, a kind of knife uſed in anatomical diſſections and operations in ſurgery.

SCALPER, or SCALPING-IRON, a ſurgeon's inſtrument uſed for ſcraping foul carious bones.

SCAMMOMY, in the materia medica, is a concreted vegetable juice of a plant of the ſame name, partly of the reſin and partly of the gum-kind, of which there are two ſorts, diſtinguiſhed by the names of the places from whence they are brought.

The Aleppo ſcammony is of a ſpongy texture, light and friable: it is of a faint diſagreeable ſmell, and its taſte is bitteriſh, very nauſeous, and acrimonious. The Smyrna ſcammony is conſiderably hard and heavy, of a black colour, and of a much ſtronger ſmell and taſte than the former, otherwiſe it much reſembles it.

In general, ſcammony is to be choſen friable and eaſily powdered, gloſſy when freſh broken; ſuch as grows white on being moiſtened with the ſpittle; free from dirt, ſand, or other foulneſſes, and not too violently acrimonious in its taſte. Scammony is in great eſteem and frequent uſe, and would be more ſo, if it were more to be depended upon: but there is ſo much difference in the purgative virtue of ſome maſſes of it, and that of others, that it is ſeldom to be depended upon alone in extemporaneous practice. It is, however, an ingredient in many compoſitions of the ſhops; and theſe are preſcribed, with other cathartics, for purging off ſerous humours. It is, in general, however, a better purge for robuſt people than for thoſe of more delicate conſtitutions, though with the correctives with which it is joined, it is given with ſafety and ſucceſs to children. The chemical writers have given us many preparations of ſcammony, among which are a tincture and a reſin; but the ſcammony in ſubſtance is preferable to either; for they both irritate more, and yet purge leſs; the reſin itſelf given in an equal doſe with the crude ſcammony, will give fewer ſtools, and thoſe attended with worſe gripings. The ancients uſed ſcammony externally for cutaneous eruptions, and to ſoften hard tumours; but at preſent it is uſed only as a purge.

SCANDALUM MAGNATUM, in law, is a defamatory ſpeech or writing to the injury of a perſon of dignity; for which a writ that bears the ſame name is granted for the recovery of damages. By ſtatute, no perſon is either by writing or ſpeaking to publiſh any falſe or ſcandalous news of any lord, prelate, officer of the government, judge, &c. on pain of impriſonment, till he produce his author; and if the ſame be publiſhed in a libel, the publiſher is indictable, and may be fined and impriſoned.

SCANNING, *Scanſio*, in poetry, the meaſuring of a verſe by feet, in order to ſee whether or no the quantities be duely obſerved.

SCANTLING, in ſhip building, is the breadth and thickneſs of a piece of timber.

SCAPE-GOAT, in Jewiſh antiquity, the goat which was ſet at liberty on the great day of expiation. See EXPIATION.

Spencer is of opinion, that the ſcape-goat was called Azazel, becauſe it was ſent to Azazel, i. e. the devil; the reaſons of which ceremony, he takes to be theſe. 1. That the goat, loaded with the ſins of the people, and ſent to Azazel, might denote the miſerable condition of ſinners. 2. The goat was ſent thus loaded to the dæmons, to ſhew that they were impure, and to deter the people from worſhipping them. 3. That the goat ſent to Azazel ſufficiently expiating the ſins of the Iſraelites, they might the more willingly abſtain from the expiatory ſacrifices of the heathens.

SCAPULA, in anatomy, the ſhoulder-blade, a triangular bone, ſituated on the outſide of the ribs, and com-

commonly extended from the ſecond to the ſeventh rib; its ſuperior poſterior angle, when it is in the leaſt ſtraining poſition, being about three inches from the ſpinal proceſſes of the vertebræ. while the long ſide between that angle and the inferior one is ſtretched obliquely forward as it deſcends, having nothing between it and the ribs except the thin extremities of ſome muſcles; but as the ſcapula advances forwards to its articulation with the arm bone, its diſtance from the ribs increaſes.

In the examination of the ſcapula, ſays Heiſter, we are to obſerve the head of the bone, with its glenoide cavity, called by ſome the acetabulum of the ſcapula; its neck; its baſe; its two angles, the ſuperior and inferior: its ſuperior and inferior coſtæ; its anterior ſurface, which is ſmooth and concave; and its poſterior, which is uneven. After theſe we are to obſerve its ſpine, its creſt, and its acromion; its ſupra and infra ſpinate cavity; its coracoide proceſs; and its two inciſures, the one between the neck and the acromion, the other behind the coracoide proceſs; and the robuſt ligament which joins the acromion and the coracoide proceſs, and prevents the luxation of the os humeri upwards.

The uſes of the ſcapula are to ſuſtain the arms, and join them to the body, to ſerve for the inſertion of ſeveral muſcles, and to add ſomewhat to the neceſſary defence of the parts contained within the thorax.

SCAPULAR, *Scapulares*, in anatomy, a name given to two pair of arteries and as many veins. The arteries are the external ſcapular artery, which is ſent from the ſubclavians to the external parts of the ſcapula; and the internal ſcapular artery, which ariſes from the axillary arteries, and goes to the parts that lie under the ſcapula. The ſcapular veins, which are alſo external and internal, ariſe in like manner from the ſubclavians.

SCAPULAR, or SCAPULARY, a part of the habit of ſeveral religious orders in the church of Rome, worn over the gown, as a badge of peculiar veneration for the bleſſed Virgin. It conſiſts of two narrow breadths or ſlips of cloth, covering the back and breaſt, and hanging down to the feet.

SCAPUS, in architecture, the ſuſt or ſhaft of a column.

In botany, the ſame word is uſed for the ſtraight ſtalk or ſtem of a plant, ſtanding upright like a pillar or column.

SCAR, or ESCHAR, the ſeam or mark of a wound after it is healed.

SCARABÆUS, the BEETLE, in zoology, a numerous genus of inſects, of the coleoptera-order: the antennæ of the beetles are of a clavated figure, and fiſſile longitudinally; and their eggs all hatch into hexapode worms, from which the young beetles are afterwards produced.

SCARFING, or ſcarphing, in ſhip building. When two pieces of timber are joined together, ſo that the end of one goes over the end of the other, being tapered, ſo that the one may be let into the other, and become even, they are ſaid to be ſcarfed: ſuch are the keel-pieces. But when the ends of the two pieces are cut ſquare and put together, they are ſaid to butt one another; and when another piece is laid upon, and faſtened to both, as is the caſe in all the frame-timbers, this is called ſcarfing the timbers; and half the piece which faſtens the two timbers together is reckoned the length of the ſcarf. *Murray's Ship-Building.*

SCARIFICATION, in ſurgery, the operation of making ſeveral inciſions in the ſkin by means of lancets, or other inſtruments, particularly the cupping-inſtrument. See CUPPING.

With regard to the uſefulneſs of ſcarification, Heiſter obſerves, that as much and as thick blood may be diſcharged this way as by phlebotomy, and that of conſequence it muſt be equally beneficial in all diſorders which require bleeding. Beſides, ſcarification is highly neceſſary in violent inflammations, incipient or confirmed mortification, peſtilential carbuncles, and the like, in order to diſcharge the ſtagnant and vitiated blood, by making many ſmall wounds or inciſions with a ſcalpel or lancet. Heiſter alſo thinks ſcarification of the gums, in the tooth-ach, may not unfrequently be very uſeful; as of the eyes in many diſorders, if performed with caution.

SCARLET, a beautiful bright red.

In painting in water colours, minium mixed with a little vermillion produces a good ſcarlet: but if a flower in a print is to be painted of a ſcarlet-colour, the lights as well as the ſhades ſhould be covered with minium, and the ſhaded parts finiſhed with carmine, which will produce an admirable ſcarlet.

To dye cloth, ſtuff, &c. a ſcarlet, let the ſtuffs be alumed, as for crimſon, in river-water; boil them for two hours, then hang them out a whole night without rinſing; but in the morning rinſe them out. Then, in order to dye them, take clean bran-water clean ſkimmed, and for every pound of goods put in an ounce of pulverized tartar; having firſt mixed one half of it with half an ounce of cochineal, and when the liquor where the remaining half of the tartar is has boiled, then put in the cochineal, &c. Boil them together, afterwards add half an ounce of aqua fortis, in which a ſmall quantity of ſal armoniac (not bigger than a pea) has been diſſolved; which muſt be put in when the ſtuffs have boiled about a quarter of an hour; then boil them together for a little while, let the liquor cool, and rinſe out the ſtuffs.

To dye a ſcarlet in grain, take ſtale clear wheat-bran liquor, a ſufficient quantity; alum, three pounds; enter twenty yards of broad-cloth, and boil it three hours; cool and waſh it; take fair water, a ſufficient quantity; hedder or ſtrawel, a fit quantity; boil them well; cool them with a little water, enter your cloth and make a bright yellow; cool and waſh it again; take freſh wheat-bran-liquor, a ſufficient quantity; madder, four pounds; enter your cloth at a good heat; handle it to a boiling, cool and waſh it well: take more freſh bran-liquor; cochineal in fine powder, five ounces; and tartar, three ounces; enter your cloth, and boil an hour or more, keeping it under the liquor, then cool and waſh it.

SCARLET-FEVER, the ſame with miliary fever. See MILIARY FEVER.

SCARP, in fortification, is the interior talus, or ſlope of the ditch next the place, at the foot of the rampart.

SCARP, in heraldry, the ſcarf which military commanders wear for ornament.

SCAVAGE, a toll or cuſtom antiently exacted by mayors, ſheriffs and bailiffs of cities and towns-corporate, and of merchant-ſtrangers, for wares expoſed and offered to ſale within their liberties; which was prohibited by 19 Hen. VII. But the city of London ſtill retains this cuſtom.

SCENE, *Scena*, in its primary ſenſe, denoted a theatre, or the place where dramatic pieces, and other public ſhews were exhibited; for it does not appear that the antient poets were at all acquainted with the modern way of changing the ſcenes in the different parts of the play, in order to raiſe the idea of the perſons repreſented by the actors being in different places.

The original ſcene for acting of plays was as ſimple as the repreſentations themſelves; it conſiſted only of a plain plot of ground proper for the occaſion, which was in ſome degree ſhaded by the neighbouring trees, whoſe branches were made to meet together, and their vacancies ſupplied with boards, ſticks, and the like; and to complete the ſhelter, theſe were ſometimes covered with ſkins, and ſometimes with only the branches of other trees newly cut down, and full of leaves. Afterwards more artificial ſcenes or ſcenical repreſentations were introduced, and paintings uſed inſtead of the objects themſelves. Scenes were then of three ſorts, tragic, comic, and ſatyric. The tragic ſcene repreſented ſtately magnificent edifices, with decorations of pillars, ſtatues, and other things ſuitable to the palaces of kings: the comic exhibited private houſes with balconies and windows, in imitation of common buildings: and the ſatyric was the repreſentation of groves, mountains, dens, and other appearances; and theſe decorations either turned on pivots, or ſlid along grooves, as thoſe in our theatres.

To keep cloſe to nature and probability, the ſcene ſhould never be ſhifted from place to place in the courſe of the play: the ancients were pretty ſevere in this reſpect,

An Engine for Saving Stones

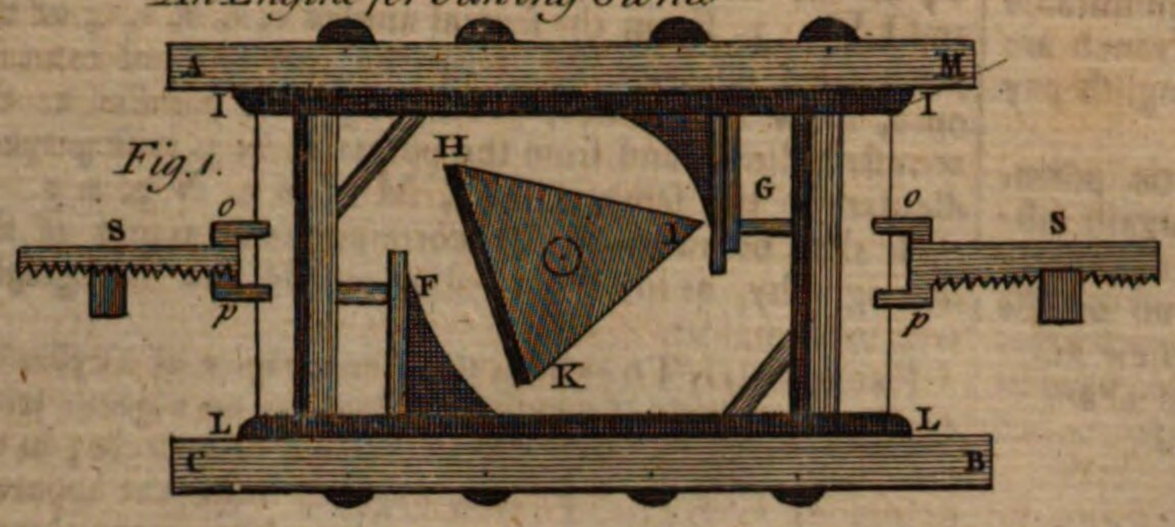


Fig. 1.

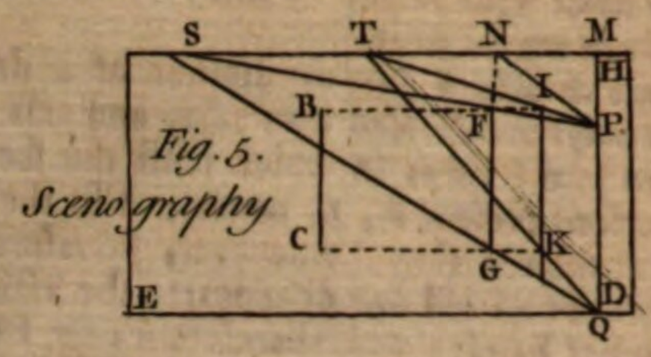
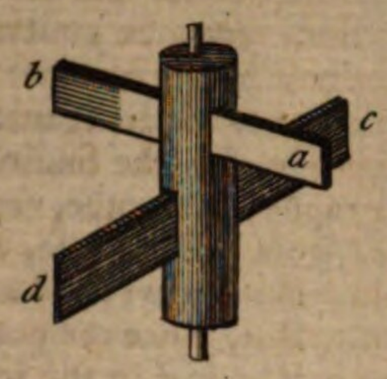
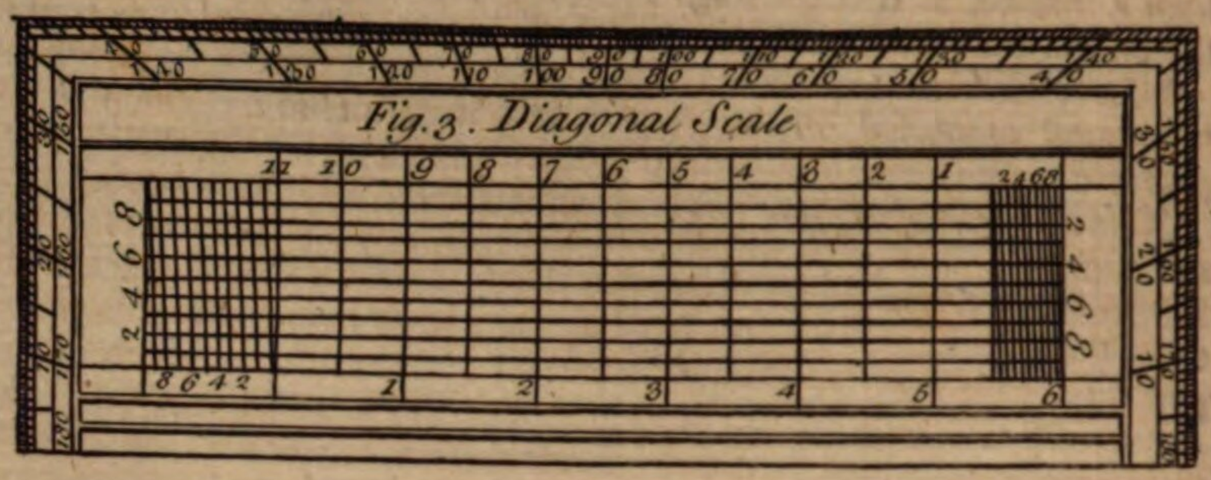


Fig. 5. Scenography





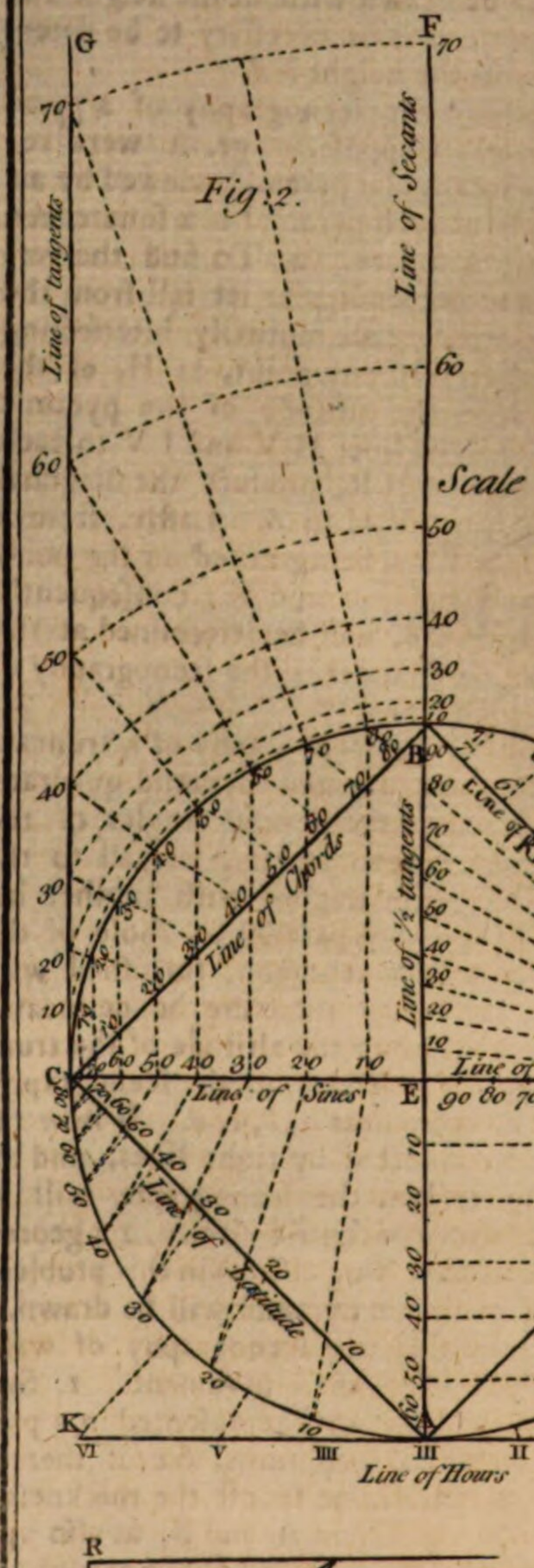


Fig. 4. Scale

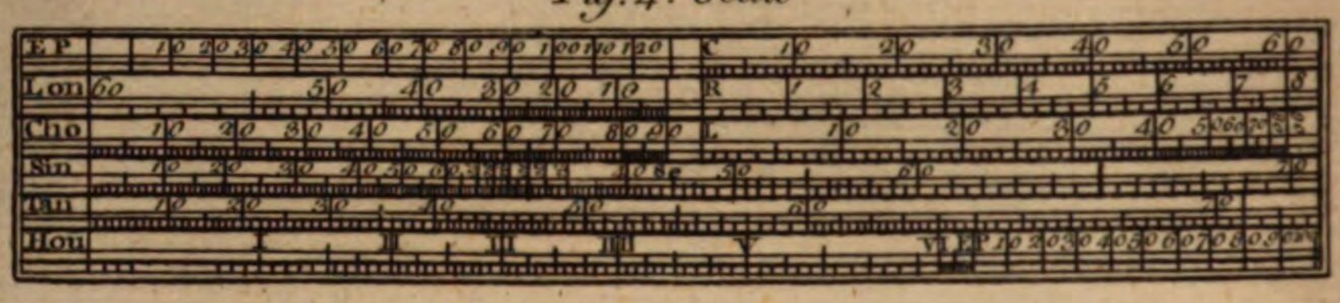


Fig. 6.

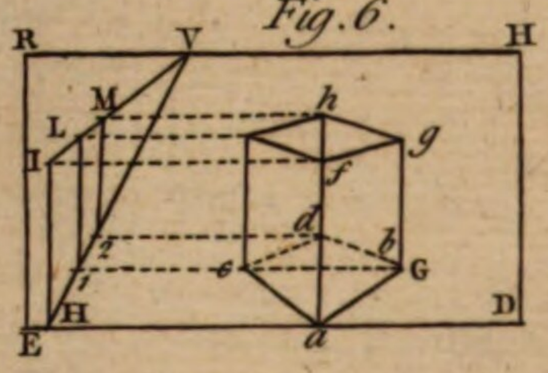


Fig. 7.

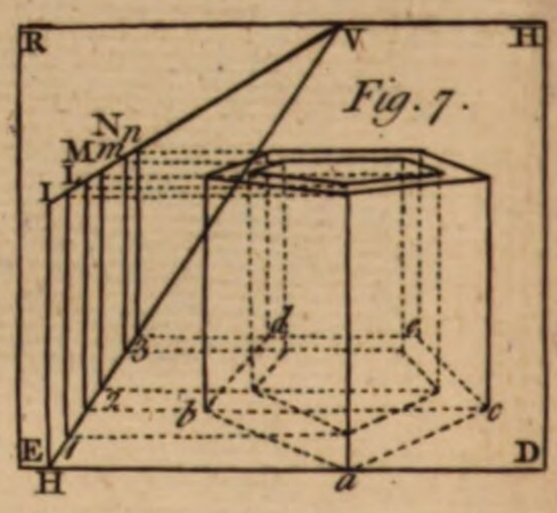


Fig. 8.

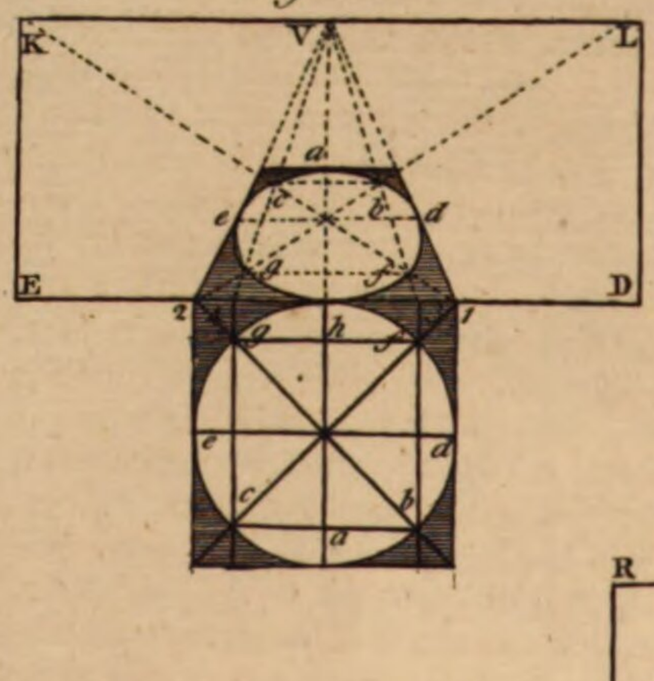


Fig. 9.

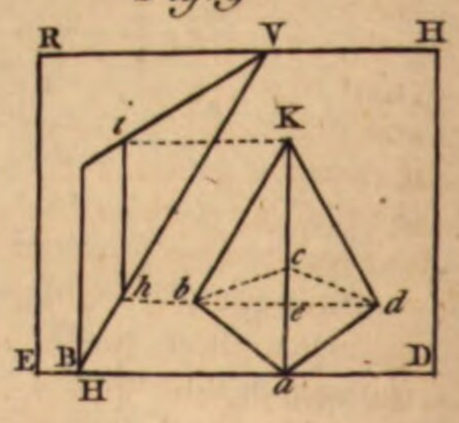


Fig. 10.

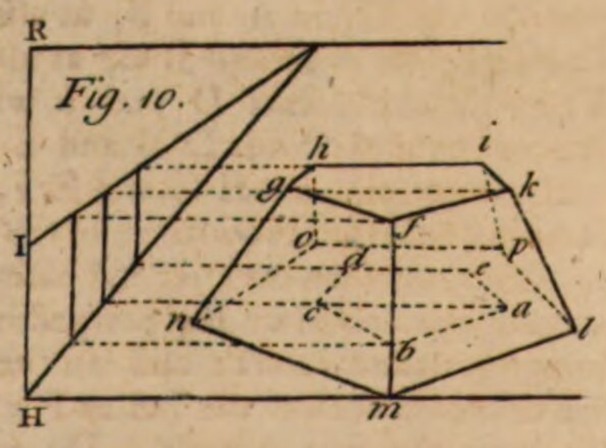
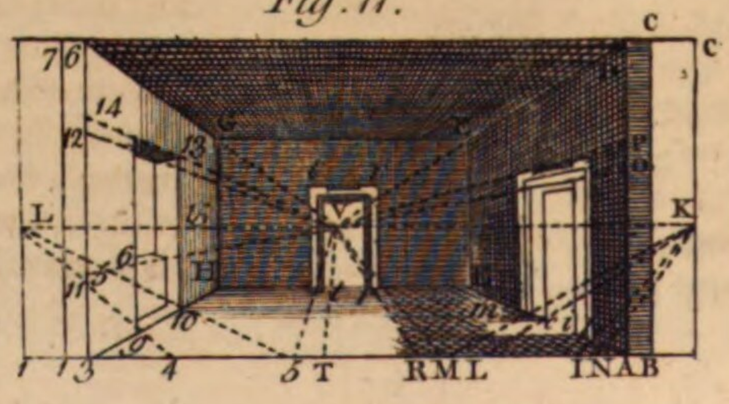


Fig. 11.



ſpect, particularly Terence, in ſome of whoſe plays the ſcene never ſhifts at all, but the whole is tranſacted at the door of ſome old man's houſe, whither, with inimitable art, he occaſionally brings the actors. The French are pretty ſtrict with reſpect to this rule; but the Engliſh pay very little regard to it.

Scene is alſo a part or diviſion of a dramatic poem. Thus plays are divided into acts, and acts are again ſubdivided into ſcenes; in which ſenſe the ſcene is properly the perſons preſent at, or concerned in the action on the ſtage at ſuch a time: whenever, therefore, a new actor appears, or an old one diſappears, the action is changed into other hands; and therefore a new ſcene then commences.

It is one of the laws of the ſtage, that the ſcenes be well connected; that is, that one ſucceed another, in ſuch a manner as that the ſtage be never quite empty till the end of the act.

SCENIC GAMES, among the ancients, were entertainments exhibited on the *ſcena* or theatre, including plays, dancing, and other theatrical performances.

The Romans were four hundred years without any ſcenic games, and at their inſtitution ſome actors were ſent for from Hetruria; who, without reciting any thing, danced to the ſound of inſtruments; at length they began to rehearſe verſe, from thence they proceeded to plays, and thus by degrees, growing more and more perfect, their ſcenical ſhews were at laſt repreſented, with a juſtneſs and magnificence beyond every thing the world had ever ſeen.

SCENOGRAPAY, in perſpective, the repreſentation of a body on a perſpective plane; or, a deſcription thereof in all its dimenſions, ſuch as it appears to the eye.

The ichnography of a building, &c. repreſents its plan, or ground-work; the orthography, is a view of the front, or one of its ſides; and the ſcenography, is a view of the whole building, front, ſides, height, and all, raiſed on the geometrical plan.

To exhibit the ſcenography of any body, 1. Lay down the baſis, ground-plot, or plan of the body, according to the method taught under the article PERSPECTIVE. 2. Upon the ſeveral points of the plan, raiſe the perſpective heights: thus will the ſcenography of the body be completed, excepting that a proper ſhade is to be added.

The method of raiſing the heights is as follows: on any point, as C (plate CXII. *fig.* 5.) to raiſe a perſpective altitude, anſwerable to an objective altitude P Q; on the terreſtrial line raiſe a perpendicular P Q, equal to the given objective altitude; from P and Q, to any point as T, draw right lines P T and Q T; from the given point C, draw a right line C K, parallel to the terreſtrial line D E, and meeting the right line Q T in K; and in the point K, upon the line K C, erect a perpendicular I K, which will be the ſcenographic altitude required.

The application of this general method of drawing the ſcenography of a body, is not ſo obvious, in every caſe, but that it may be neceſſary to illuſtrate it by a few examples.

Example I. To exhibit the ſcenography of a cube, viewed by an angle: 1. As the baſis of a cube viewed by an angle, ſtanding on a geometrical plane is a ſquare, viewed by an angle; draw a ſquare, viewed angular-wiſe, on the perſpective table, or plane. 2. Raiſe the ſide H I (*fig.* 6.) of the ſquare perpendicularly on each point of the terreſtrial line D E; and to any point, as V, of the horizontal line H R, draw the right line V I and V H. 3. From the angles *d*, *b*, and *c*, draw *c* 1, *d* 2, &c. parallel to the terreſtrial line D E. 4. From the points 1 and 2, raiſe L 1 and M 2 perpendicular to the ſame. Laſtly, ſince H I is the height to be raiſed in *a*, L I in *c* and *b*, and M 2 in *d*; in *a* raiſe the line *f a* perpendicular to *a* E; in *b* and *c*, raiſe *b g* and *c e* perpendicular to *b c* 1; and, laſtly, raiſe *d h* perpendicular to *d* 2, and make *a f* = H I, *b g* = *e c* = I. 1, and *h d* = M 2; if then the points *g*, *h*, *e*, *f*, be connected by right lines, the ſcenography will be compleat.

Example II. To exhibit the ſcenography of a hollow quinquangular priſm. 1. Since the baſe of a hollow quinquangular priſm, ſtanding on a geometrical plane, is a pentagon, with a limb or breadth of a certain dimenſion, find the appearance of this pentagon on a table, or plane. 2. On any point, as H, of the terreſtrial line D E (*fig.* 7.) raiſe a perpendicular H I, equal to the objective altitude, and to any point, as V, of the horizontal line H R, draw the lines H V and I V. 3. From the ſeveral angles *a*, *b*, *d*, *e*, *c*, of the perſpective ichnography, both the internal and external ones, draw right lines, as *b* 2, *d* 3, &c. parallel to the terreſtrial line; and from the points 1, 2, 3, raiſe perpendiculars to the ſame, as L 1, M 2, *m* 2, N 3, *n* 3. If theſe then be raiſed in the correſpondent points of the ichnography, as in the preceding article, the ſcenography will be compleat.

Example III. To exhibit the ſcenography of a cylinder. 1. Since the baſe of a cylinder, ſtanding on a geometrical plane, is a circle, ſeek the appearance of a circle; in the points *a*, *b*, *d*, *f*, *h*, *g*, *e*, *c*, (*fig.* 8.) raiſe the apparent altitudes, as in the preceding articles. If now their upper lines be connected by curve lines, in the baſe *a*, *b*, *d*, *f*, *c*, *h*, *e*, *c*, the ſcenography of their circle will be compleat.

It is evident that thoſe lines are to be omitted, both in the plan and in the elevation, which are not expoſed to the eye; though they are not to be diſregarded from the beginning, as being neceſſary for the finding of other lines; e. gr. in the ſcenography of the cube, viewed angle-wiſe, the lines *b d* and *d e* (*fig.* 6.) in the baſe, and the line *d h* in the elevation, are hid from the eye, and are therefore omitted in the deſcription. But, ſince the point H is not to be found, unleſs the point *d* be had in the ichnography, nor the lines *g h* and *d e* be drawn without the height *d h*, the appearance of the point *d* is as neceſſary to be determined in the operation, as the height *h d*.

Example IV. To exhibit the ſcenography of a pyramid ſtanding on its baſe. Suppoſe, e. gr. it were required to delineate a quadrangular pyramid, viewed by an angle: 1. Since the baſe of ſuch pyramid is a ſquare ſeen by an angle, draw ſuch a ſquare. 2. To find the vertex of the pyramid, i. e. a perpendicular let fall from the vertex to the baſe, draw diagonals mutually interſecting each other in *e* (*fig.* 9.) 3. On any point, as H, of the terreſtrial line D E, raiſe the altitude of the pyramid H I; and, drawing the right lines H V and I V to each point of the horizontal line H R, produce the diagonal *r b*, until it meet the line V H in *h*. Laſtly, from *h* draw *h i* parallel to H I. This, being raiſed on the point *e*, will give the vertex of the pyramid K; conſequently the lines *d* K, K *a*, and K *b*, will be determined at the ſame time. After the like manner is the ſcenography of a cone delineated.

Example V. To exhibit the ſcenography of a truncated pyramid. Suppoſe the truncated pyramid quadrangular: firſt then, if from the ſeveral angles of the upper baſe be conceived perpendiculars, let fall to the lower baſe, we ſhall have a pentagon, with another inſcribed therein, whoſe ſines are parallel to thoſe of the former; this coincides with a pentagon, furniſhed with a rim or breadth, &c. and may therefore be delineated in the ſame manner. 2. Raiſing the altitude of the truncated pyramid I H (*fig.* 10.) determine the ſcenographic altitudes to be raiſed in the points *a*, *b*, *c*, *d*. If now the points *f*, *g*, *h*, *i*, *k*, be connected by right lines, and the lines *i k*, *f m*, *g n*, be drawn, the ſcenography will be compleat. By drawing two concentric circles in a geometrical plane, and doing every thing elſe, as in this problem, the ſcenography of a truncated pyramid will be drawn.

Example VI. To exhibit the ſcenography of walls, columns, &c. or to raiſe them on a pavement. 1. Suppoſe a pavement A F, H I (*fig.* 11.) repreſented in a plan, together with the baſes of the columns, &c. if there be any. 2. Upon the terreſtrial line ſet off the thickneſs of the wall B A and 1, 3. 3. Upon A and B, as alſo upon 3 and 1, raiſe perpendiculars A D and B C, as alſo 3, 6, and 1, 7. 4. Connect the points D and 6 with the principal point V, by the right lines D V and 6 V. 5. Upon F and H raiſe perpendiculars H G and E F. Thus will all the walls be delineated. Now to raiſe the pillars, &c. there needs nothing but from their ſeveral baſes (whether ſquare or circular) projected on the perſpective plan, to raiſe the indefinite perpendiculars; and on the fundamental line, where interſected by the radius F *a* paſſing through the baſe, raiſe the true altitude A D; for D V, being drawn as before, the ſcenographical altitudes will be determined.

Example VII. To exhibit the ſcenography of a door in a building: Suppoſe a door required to be delineated in a wall D E F A (*fig.* 11.) 1. Upon the fundamental line ſet off its diſtance A N from the angle A, together with the breadths of the poſts N I and L M, and the breadth of the gate itſelf L I. 2. To the point of diſtance K, from the ſeveral points N, I, L, M, draw right lines K N, K I, K L, K M, which will determine the breadth of the door *l i*, and the breadths of the poſts *i n* and *m l*. 3. From A to O ſet off the height of the gate A O, and from A to P, the height of the poſts A P. 4. Join O and P with the principal point by right lines P V and O V. 5. Then, from *n*, *i*, *l*, *m*, raiſe perpendiculars, the middle ones whereof are cut by the right line O V in *o*, and extreams, by the right line V P in *p*. Thus will the door be delineated, with its poſts; if the door were to have been exhibited in the wall E F G H, the method would be nearly the ſame: For, 1. Upon the terreſtrial line, ſet off the diſtance of the door from the angle, and thence alſo the breadth of the door R T. 2. From R and T draw right lines to the principal point V, to have the breadth *r t* in the perſpective plan. 3. From *r* and *t* raiſe indefinite perpendiculars to F H. 4. From A to O ſet off the true height A O. Laſtly, from O to the principal point V draw the right line O V, interſecting E F in *z*, and make *r r* and *t t* equal to F *z*. Thus is the door *r r*, *t t*, drawn, and the poſts are eaſily added, as before.

Example VIII. To exhibit the ſcenography of windows in a wall.—When you know how to repreſent doors, you will find no difficulty in adding windows; all that is here further required, being to ſet off the height of the window from the bottom of the ground. The whole operation is as follows: 1. From 1 to 3, ſet off the thickneſs of the wall at the window; from 3 to 4, its diſtance from the angle 3: and from 4 to 5, its breadth. 2. From 4 and 5, to the point of diſtance L, draw the right lines L 5 and L 4, which will give the perſpective breadth 10, 9 of the window. 3. From 10 and 9, raiſe perpendiculars to the pavement, that is, draw indefinite parallels to 6, 3. 4. From 3 to 11, ſet off the diſtance of the window from the pavement 3, 11, and from 11 to 12, its height 11, 12. Laſtly, from 11 and 12, to the principal point V, draw the lines V 11 and V 12, which interſecting the perpendiculars 10, 13, and 9, 14, in the points 13 and 14, as alſo in 15 and 16, will exhibit the appearance of the window.

From theſe examples, which are only applications of the firſt grand rule, it will be eaſily perceived what method to take to delineate any other object, and at any height from the pavement.

SCENOPEGIA, in Jewiſh antiquity, the ſame with the feaſt of tabernacles.

SCEPTER, a kind of royal ſtaff, or battoon, borne by kings, on ſolemn occaſions, as an enſign of command and authority.

SCEPTER, in aſtronomy, one of the ſix new conſtellations of the ſouthern hemiſphere, conſiſting of ſeventeen ſtars.

SCEPTICISM, the doctrines and opinions of the Sceptics, whoſe diſtinguiſhing tenet was, that all things are uncertain and incomprehenſible, and that the mind is never to aſſent to any thing, but to remain in perpetual doubt and ſuſpence. This doctrine was alſo called Pyrrhoniſm, from the name of its author.

SCHEAT, or SEAT, a fixed ſtar of the ſecond magnitude, in the juncture of the leg with the left ſhoulder of Pegaſus.

SCHEUCHZERIA, in botany, a genus of plants, having no corolla; the fruit conſiſts of three roundiſh compreſſed inflated bivalve reflexo-diſtant capſules; the ſeed is ſingle and oblong; there are ſometimes ſix germina, and as many capſules, but three is the more natural and uſual number.

SCHINUS, in botany, a genus of plants, the corolla whereof conſiſts of five patent petals; the fruit is a globoſe berry, containing a large globoſe ſingle ſeed.

SCHISM, a ſeparation, or breaking off from communion with any church; on account of ſome diſagreement in matters of faith or diſcipline.

Eccleſiaſtical hiſtory preſents us with a view of ſeveral conſiderable ſchiſms, in which large bodies of men ſeparated from the communion of the church. Such were in the fourth century the ſchiſms of the Donatiſts, and the many ſects that ſprung up in the church, as the Photinians, Apollinarians, &c. the ſchiſm of the church of Antioch, occaſioned by Lucifer, biſhop of Cagliari, in Sardinia; in the fifth century, the ſchiſm of the church of Rome, between Laurentius and Symmachus; in the ninth century, the ſeparation of the Greek church from the Latin; and particularly the grand ſchiſm of the popes of Rome and Avignon, in the fourteenth century, which laſted till the end of the council of Piſa, in 1409.

The Romaniſts reckon thirty-four ſchiſms in their church, and beſtow the name Engliſh ſchiſm on the Reformation in this kingdom. Thoſe of the church of England, again, apply the term ſchiſm to the ſeparation of the nonconformiſts, viz. the preſbyterians, independants, quakers, &c. who contend for a further reformation.

SCHOLASTIC, σχολαστικὸς, ſomething belonging to the ſchools. See SCHOOL.

Scholaſtic was a long time a title of honour, at firſt only given to ſuch as diſtinguiſhed themſelves by their eloquence in declaiming, &c. After Nero, this appellation was beſtowed upon advocates, and afterwards it became reſtrained to ſuch as had the government of eccleſiaſtical ſchools, eſtabliſhed under the firſt race of French kings, who inſtructed the clerks of the church firſt in the humanities, then in theology and the liturgy. Among the Greeks, this was the name of an office or dignity anſwering to our divine or theologue.

Scholaſtic divinity is that part or ſpecies of divinity which clears and diſcuſſes queſtions by reaſon and arguments, in which ſenſe it ſtands, in ſome meaſure, oppoſed to poſitive divinity, which is founded on the authority of fathers, councils, &c. The ſchool-divinity is now fallen into the loweſt contempt, and is ſcarce regarded any where, but in ſome of the univerſities, where they are ſtill by their charters obliged to teach it.

SCHOLIAST, or COMMENTATOR, a grammarian, who writes ſcholia, that is, notes, gloſſes, &c. upon antient authors, who have written in the learned languages.

SCHOLIUM, a note, annotation, or remark, occaſionally made on ſome paſſage, propoſition, or the like. This term is much uſed in geometry, and other parts of mathematics, where after demonſtrating a propoſition, it is cuſtomary to point out how it might be done ſome other way, or to give ſome advice, or precaution, in order to prevent miſtakes, or add ſome particular uſe, or application thereof.

SCHOOL, *Schola*, a public place, wherein the languages, humanities, or other arts and ſciences are taught. Thus we ſay, grammar-ſchool, writing-ſchool, &c.

SCHOONER, in navigation, a veſſel navigated with two maſts, and two large boom-ſails on the main and fore-maſts, beſides the uſual ſmall ſails. They are generally built very light, as being principally intended for ſwiftneſs, and to ſail in ſeas which are ſeldom frequented with ſtormy weather; ſuch are the latitudes between or near the tropics.

The largeſt veſſels of this kind are built in the iſland of Bermuda, where they are framed of cedar.

SCHWALBEA, in botany, a genus of plants, the corolla whereof conſiſts of a ringent ſingle petal, the tube is of the length of the cup, the limb is erect, the ſuperior lip is erect, concave, and quite entire, the lower one is trifid and obtuſe; the fruit is either a bilocular capſule, or there is no pericarpium; the ſeed is ſingle, roundiſh, and ſmall.

SCIÆNA, in ichthyology, a genus of fiſhes; the whole head and covering of the gills are ſcaly, and one of the laminæ of theſe coverings ſerrated at the edges; the body is compreſſed and broad, the back is acute, there are teeth in the jaws and fauces, the palate and tongue are ſmooth; there is only one fin on the back, which is divided in the middle to the very baſe; the tail is equal at the extremity; this genus comprehends the umbra and the umbrino.

SCIARRI, in natural hiſtory, the matter which runs down in burning torrents from the craters of volcanos, and which probably contains mineral and metallic particles, it being ponderous and hard.

Some of the ſciarri are coarſe, and others fine and poliſhed on the ſurface; ſome of them are black, others grey, others reddiſh, and others of the colour of iron; and many of them have coverings of pure ſulphur over their whole ſurface. They ſeem to be the reſult of many ſorts of minerals melted together.

SCIATICA, the HIP-GOUT, a violent and obſtinate pain in the hip, chiefly in the joint, where the head of the thigh-bone is received into the acetabulum of the coxendix. This pain will ſometimes extend itſelf to the lower part of the loins, to the thigh, leg, and even the extremity of the foot, yet outwardly there is no ſwelling, no inflammation, nor change of colour in the ſkin; ſometimes there is ſuch a ſpaſm of the muſcles on the ſide affected, that the patient cannot ſtand upright without the utmoſt pain. When the ſciatica has continued very long, there is ſuch a collection of pituitous humour in the cavity of the joint, that by relaxing the ligaments, it often cauſes a luxation. Sometimes it cauſes an aridura, or waſting away of the adjacent parts. When the pain leaves the hip, and moves downwards, it is a ſign that the ſpaſms are reſolved; a violent motion of the body generally exaſperates the pain. This diſorder may ariſe from the ſame cauſe with that which produces the gout; but it is moſt generally the effect of catching cold, or being expoſed to the open air; it may alſo be occaſioned by contuſions and venereal diſorders.

After a gentle cathartic, or clyſter, bleeding will be proper, eſpecially in the ancle; alſo leeches applied to the hæmorrhoidal veins, have been found beneficial; ſtrong purges are hurtful, but mercurius dulcis with ſcammony, or ſome other purgative, will be of ſervice; ſome give mercurial emetics, and afterwards mercurial purgatives, repeated twice a week, or as occaſion requires, for ſix times. If the patient is old, lenient purgatives will be moſt proper, and on intermediate days a doſe of calomel, which is afterwards to be purged off, and ſo repeated alternately for ſome time. Outwardly, the linimentum ſaponaceum is recommended by Riverius, Junker, and others; the part is to be anointed with it near the fire. Riverius ſays, he has known an obſtinate ſciatica cured in one day, by applying ſix cupping glaſſes on and about the part affected, and then anointing it with oil of bricks hot, and afterwards covering it with a linen-cloth, made very hot. Zacutus Luſitanus affirms, that the ſciatica has been cured in a few hours, by applying eight or ten leeches to the part affected. Baglivi obſerves, that if nothing elſe will do, recourſe muſt be had to cauſtics, particularly the leaves of ranunculus, or a mixture of quick lime, and ſoft ſoap.

SCIENCE, *Scientia*, in philoſophy, denotes any doctrine, deduced from ſelf-evident and certain principles, by a regular demonſtration.

Science may be properly divided as follows: 1. The knowledge of things, their conſtitutions, properties, and operations; this, in a little more enlarged ſenſe of the word, may be called φυσικὴ, or natural philoſophy; the end of which is ſpeculative truth.

2. The ſkill of rightly applying theſe powers, πρακτικὴ: the moſt conſiderable under this head is ethics, which is the ſeeking out thoſe rules and meaſures of human actions that lead to happineſs, and the means to practiſe them; and the next is mechanics, or the application of the powers of natural agents to the uſes of life.

3. The doctrine of ſigns, σημειωτικὴ; the moſt uſual of which being words, it is aptly enough termed logic.

This, ſays Mr. Locke, ſeems to be the moſt general, as well as natural, diviſion of the objects of our underſtanding. For a man can employ his thoughts about nothing but either the contemplation of things themſelves for the diſcovery of truth; or about the things in his own power, which are his actions, for the attainment of his own ends; or the ſigns the mind makes uſe of, both in the one and the other, and the right ordering of them for its clearer information.

All which three, viz. things, as they are in themſelves knowable; actions, as they depend on us in order to happineſs; and the right uſe of ſigns, in order to knowledge, being *toto cælo*, different, they ſeem to be the three great provinces of the intellectual world, wholly ſeparate and diſtinct one from another.

SCIENTIFIC, or SCIENTIFICAL, ſomething relating to the pure, ſublimer ſciences; or, that abounds in ſcience or knowledge.

SCILLA, SQUILL, or SEA-ONION, a plant with a large bulbous onion-like root: from which riſe, firſt, a naked ſtalk, bearing ſeveral hexapetalous white flowers, and afterwards large green lily-like leaves with a remarkable rib in the middle of each. It grows ſpontaneouſly on ſandy ſhores in Spain and in the Levant, from whence we are annually ſupplied with the roots. They ſhould be choſen large, plump, freſh, and full of a clammy juice: ſome are of a reddiſh colour and others white, but no difference is obſerved in the qualities of the two ſorts, and hence the college allows both to be taken promiſcuouſly.

This root is to the taſte very nauſeous, intenſely bitter, and acrimonious; much handled, it exulcerates the ſkin. Taken internally, it acts as a powerful attenuant and aperient: in doſes of a few grains it promotes expectoration and urine: in ſomewhat larger ones, it proves emetic and ſometimes purgative. It is one of the moſt certain diuretics in hydropic caſes, and expectorans in aſthmatic ones, where the lungs or ſtomach are oppreſſed by tenacious phlegm, or injured by the imprudent uſe of opiates.

This medicine, on account of its ungrateful taſte, is moſt commodiouſly taken in the form of pills; into which the freſh root may be reduced, by beating it with an equal quantity of ammoniacum, and then adding the ſame quantity of ſome warm ſpice, as leſſer cardamom-ſeeds in powder: if the maſs ſhould prove too ſtiff, it is ſoftened with a little balſam of Copaiba. In whatever form ſquills are given, unleſs when deſigned to act as an emetic, the addition of ſome grateful aromatic material is of uſe, to prevent the nauſea which of themſelves they are very apt, even in ſmall doſes, to occaſion.

The freſh root loſes in drying about four fifths of its weight, without any conſiderable loſs of its taſte, or virtue; the vapour which exhales appearing to be little other than merely aqueous. Hence four grains, which are the mean doſe of the dry root in powder, are equivalent to near a ſcruple of the freſh ſquill. The moſt convenient way of drying it is, after peeling off the outer ſkin, to cut the roots tranſverſly into thin ſlices (not to ſeparate the coats as has been uſually directed) and expoſe them to a gentle warmth.

The ancients, in order to abate the acrimony of the ſquill for certain purpoſes, encloſed it entire (after ſeparating the ſkin, and the fibres at the bottom with the hard part from which they iſſue) in a paſte made of flour and water, and then baked it in an oven, till the paſte became dry, and the ſquill ſoft and tender throughout. The ſquill, ſo prepared, was beaten with two thirds its weight of flour, the mixture formed into troches, and dried with a gentle heat. Theſe troches were ſuppoſed to be alexipharmic, and in this light were made an ingredient in theriaca, for which purpoſe they are ſtill retained.

Water, wine, proof ſpirit, and rectified ſpirit, extract the virtues both of the freſh and the dry root. Nothing riſes in diſtillation with any of theſe menſtrua, the entire bitterneſs and pungency of the ſquill remaining concentrated in the inſpiſſated extracts: the ſpirituous extract is in ſmaller quantity than the watery, and of a proportionably ſtronger almoſt fiery taſte.

Alkalies conſiderably abate both the bitterneſs and acrimony of the ſquill: vegetable acids make little alteration in either, though the admixture of the acid taſte renders that of the ſquill more ſupportable. Theſe acids extract its virtue equally with watery or ſpirituous menſtrua; and, as an expectorant in diſorders of the breaſt, excellently coincide with it. The college of London directs an acetous tincture to be prepared, by macerating a pound of the dry roots in ſix pints of vinegar, with a gentle heat: to the liquor, preſſed out, and after ſettling poured off from the fæces, one twelfth its quantity of proof ſpirit is added, to prevent its growing ſoon

feculent. The college of Edinburgh orders freſh ſquills, cut in thin ſlices, to be taken in the ſame quantity as the dry in the above preſcription, and the maceration to be continued, in the ſun's heat, for forty days. A ſcillitic oxymel is obtained by boiling a quart of the acetous tincture with three or four pounds of clarified honey, till the mixture acquires the conſiſtence of a ſyrup. Theſe preparations are uſed, as expectorants, in doſes of one, two, or three drams, along with cinnamon or ſome other grateful water: where the firſt paſſages are overloaded with viſcid phlegm, an ounce or more is given at once, to procure a more ſpeedy and effectual evacuation by vomit.

SCIOPTIC, a ſphere, or globe of wood, with a circular hole or perforation, wherein a lens is placed. It is ſo fitted that, like the eye of an animal, it may be turned round every way, to be uſed in making experiments of the darkened room.

SCIRE-FACIAS, in law, a judicial writ moſt commonly iſſued to call a perſon to ſhew cauſe to the court whence it iſſues, why execution of a judgment paſſed ſhould not be made out; as where a plaintiff has recovered debt or damages in a court of record, and does not take out execution in a year and a day after judgment recovered; in that caſe he ſhall have this writ to ſummon the defendant to ſhew cauſe why execution ſhould not be had againſt him upon the ſaid judgment; which, if the defendant does not, judgment is given and the plaintiff ſhall have execution. Where a plaintiff or defendant dies, execution may not be ſued out on a judgment till the writ of ſcire-facias is brought and judgment given thereupon. A ſcire-facias muſt likewiſe iſſue where judgment is recovered againſt a femme ſole who marries within the year and day, to ſummon the huſband to ſhew cauſe, &c. And when a judgment is obtained againſt a teſtator, a ſcire-facias iſſues againſt the executor, though within a year after the judgment is had; and alſo againſt an adminiſtrator to an inteſtate.

SCIRRHUS, in ſurgery, a hard tumour without pain, though not abſolutely without ſenſation.

A ſcirrhus may be produced by whatever is capable of coagulating, inſpiſſating, or drying the liquids in the glands; and, therefore, the ſcirrhus may be in any of the glands, but eſpecially ſuch as contain an eaſily inſpiſſated liquor, or from their ſituation, diſpoſe their contents to a ſtagnation.

The efficacy of quickſilver, in removing obſtructions, is univerſally known, and both the internal and external uſe of it has often greatly contributed to the cure of a benign and beginning ſcirrhus: for when it has acquired a ſtony hardneſs, and begins to be malignant, no relief can be expected from the ſtrongeſt mercurial preparations, nor from a ſalivation excited by quickſilver, but all the ſymptoms are rather increaſed by theſe means; and, in conſequence of the increaſed motion of the humours, the ſcirrhus is ſooner changed into a cancer. See CANCER.

When the ſcirrhus will not yield to medicines, if its place, ſituation, adjacent parts, mobility, the ſtate of the diſorder, and the ſtrength and condition of the patient permit, it is with all expedition to be totally extirpated with the knife.

SCIRRHUS *Hepatis*, in medicine, a diſeaſe conſiſting in an indurated tumor of the liver, occaſioned by a ſtagnation of the humours which grow thick there, from an exhalation of their more fluid and ſubtile parts.

This differs from the infarctus hepatis, not only in degree but in its ſymptoms, for it almoſt always is attended with a hectic, or with œdemato-hydropic ſwellings.

Signs of it. Theſe are a tumor and hardneſs in the right hypochondrium, or region of the liver, always evident to the patient, and often ſenſibly perceived by any body elſe, on touching the part. To this are to be added dull tenſive pains, and a ſenſe of weight hanging there, and uſually aſthmatic ſymptoms, and a dry cough. It becomes painful to lie on the left, or oppoſite ſide; and with theſe a hectic comes on, with a waſting of the upper parts, and ſwelling of the inferior ones; firſt of the feet, but afterwards upwards to the belly, which finally become very obſtinate and truly aſcitic. The urine in this caſe is ſmall in quantity, and of a deep orange colour, and thick conſiſtence. It has uſually a mucid ſediment, and ſometimes a thick one of a roſe colour.

Cauſes of it. Theſe are uſually either an omiſſion of artificial diſcharges of the blood, by habitual bleedings at ſpring and autumn, or a ſuppreſſion of the natural ones, by the menſes or hæmorrhoidal veſſels; an improper treatment of intermitting fevers with aſtringents, of quartans with large quantities of bark, and of acute fevers with too cooling a regimen, or a violent quantity of the volatile ſalts, or a condenſation of the humours in a ſimple infarction, by means of cold external applications. The ſtopping hæmorrhages, which nature had brought on for her relief in plethoras, have alſo been ſometimes known to occaſion a ſcirrhus of the liver; as have alſo external injuries by blows, falls, and the like.

Prognoſtics. A recent ſcirrhus of the liver admits of a cure, but this not without great difficulty, and in a more confirmed one there is very little hope. This tumor has a continual tendency to corruption, either by ſphacelation, or by an inflammatory ſuppuration; neither of which can happen ſucceſsfully, for the firſt muſt occaſion inſtantaneous death, and the latter exulceration, and a ſucceeding fatal hectic.

A ſcirrhus of the liver often follows, and ſometimes precedes a jaundice of the moſt violent kind.

Method of treating it. The bowels are firſt to be cleanſed and relaxed by a clyſter, made of a decoction of mallows, camomile flowers, mullein, and fennel ſeed; after this, bleeding in the foot is to be ordered, and then the nitrous and other reſolvent medicines are to be given, ſuch as tartar of vitriol, and the like. After this medicated wines ſhould be drank as the common drink, prepared with bryony and arum roots, centaury, hyſſop, and maidenhair leaves, ſaſſafras, ſenna, black hellebore, and rhubarb; and, externally, plaſters of the reſolvent and ſtrengthening kinds are to be applied. But, after all directions for the treatment, it is to be acknowledged, that an obdurate and inveterate ſcirrhus admits of no remedy. *Junker's Conſ. Med.*

SCISSARS, a well known inſtrument for cutting any thing aſunder. See FORCEPS.

SCLEROPHTHALMIA, in medicine, a ſpecies of ophthalmia, wherein the eye is dry and inflamed, as are alſo the eye-brows.

SCLEROTICA, in anatomy, one of the tunics, or coats, of the eye: it is hard, opake, and extended from the cornea to the optic nerve; its forepart is tranſparent, and called the cornea.

SCLEROTICS, medicines proper to harden and conſolidate the fleſh of the parts to which they are applied; as purſlain, houſe-leek, flea-wort, garden-night-ſhade, &c.

SCOLOPAX, the WOOD-COCK, in ornithology, a ſpecies of numenius, with a black line on each ſide the head: it is a very beautiful as well as delicate bird, ſomewhat ſmaller than the partridge; the upper part of its body being of a mixed colour, mottled with black grey, and a reddiſh-brown: the breaſt and belly are a pale-grey, with little tranſverſe lines of a bright brown: the upper part of the throat is of a whitiſh-yellow, and the hinder part of the head chiefly black, with a few tranſverſe lines of brown on it: the male is ſomewhat darker than the female, in its general colouring. See NUMENIUS.

SCOLOPENDRA, in zoology, an inſect with a very ſlender and long body, and furniſhed with a vaſt number of legs.

SCONCE, in fortification, a ſmall field-fort, built for the defence of ſome paſs, or other poſt. See the article FORT.

SCORBUTUS, the SCURVY, in medicine. See SCURVY.

SCORDIUM, WATER GERMANDER, in botany, is comprehended by Linnæus among the teucriums. See TEUCRIUM.

It is celebrated for its ſudorific and alexipharmic virtues, and is accordingly preſcribed in malignant diſorders: but it is never uſed alone, being only kept in the ſhops as an ingredient of the confectio Fracaſtorii, which takes its name of diaſcordium from it.

SCORE,

SCORE is ſometimes uſed to denote the number twenty.

SCORIA, or DROSS, among metallurgiſts, is the recrements of metals in fuſion; or, more determinately ſpeaking, is that maſs which is produced by melting metals and ores, and when cold is brittle, and not diſſoluble in water; being properly a kind of glaſs.

Some authors call by this name that ſaline maſs which is produced by melting ores and metals together with ſaline and reducing fluxes. But the word *ſcoria* is not properly to be underſtood of all this maſs, but only of the vitrified particles which are lodged between, and adhere to the ſmall maſſes of the ſalts, and which may be ſeparated from them by water.

SCORIFICATION, in metallurgy, is the art of reducing a body, either entirely, or in part, into ſcoria.

It is uſed by metallurgiſts, in order that any metal, impriſoned in any ſolid body, may on account of its weight, deſcend and ſeparate itſelf therefrom; and finally, if that be required, be either wholly or in part converted into ſcoria. All fixed bodies are ſubject to this alteration, not totally excepting even gold and ſilver. There are alſo, among the volatile bodies, ſome that may be fixed, and which aſſume the name of ſcoriæ, by adding fixed bodies to them.

It is often proper to make this ſcorification in a veſſel that may abſorb the ſcoriæ, and retain only the metallic part of the maſs under trial. In this caſe the operation is called coppelling; and veſſels made of aſhes, called teſts and coppels, ſerve for this purpoſe. It is evident, in theſe proceſſes, that a great attenuation of the ſcoriæ is neceſſary, that they may be able to paſs through the veſſel; nor is there any fitter body to promote this operation than lead, which, by its undergoing itſelf a like attenuation in the fire, diſpoſes other bodies to be reduced into a ſubtile ſcoria for the ſame attenuation.

SCORPION, *Scorpio*, in natural hiſtory, an inſect frequently found in the hot countries. The opinions of authors are very different as to the ſting of this creature, ſome aſſerting that there is an opening in it, through which a poiſonous liquor is thrown into the wound made by it, as is the caſe in the tooth of the viper, &c. and others affirming that there is no ſuch opening. Galen affirms that there is none, but moſt of the writers of the middle ages aſſert that there is. But the whole is ſet in the cleareſt light by Signior Redi, who took the pains of examining microſcopically the ſtings of the ſcorpions brought alive from Tunis, Egypt, and Italy. Theſe he nicely examined by the beſt glaſſes in the muſæum of the great duke of Tuſcany, and could find no aperture: but, not ſatisfied with this, he preſſed the ſtings to try if he could make any liquor flow out of them; they were, however, ſo hard and horny, that ſqueezing could have no effect on them; and, finally, he cauſed a ſcorpion to ſtrike upon a plate of iron, but no liquid was found thereon; ſo that he began to conclude Galen's opinion right, when he accidentally diſcovered an exceedingly ſmall drop of white liquor upon the ſting, and this he afterwards found in all the trials he made with ſeveral ſcorpions. And Mr. Lewenhoek diſcovered an opening on each ſide of the ſting of this creature, for the emiſſion of the poiſon, which he ſuppoſes is not diſcharged, till the ſting is buried in the wound. *Baker's Microſcope.*

Mr. de Maupertuis, having cauſed ſcorpions to bite ſeveral animals, of which very few died, or ſuffered any more than the pain of the ſting, is of opinion, that oil of ſcorpions, and other vulgar antidotes to the poiſon of theſe animals, have rather got their reputation from the innocence of the ſting of theſe creatures, than from any conſiderable virtue in the medicines. *Mem. de l'Acad. Scienc.* 1731.

Water SCORPION, *Scorpio Paluſtris*, a name given to a very remarkable ſpecies of water inſect. It is a very thin and light little creature, yet is but a very ſlow mover. Its head is very ſmall, and is hard to the touch, and of a paler brown than the reſt of the body; and this is terminated by a very fine and ſharp proboſcis, of the ſame colour and texture. The eyes are ſmall, but prominent, and very hard and black. The ſhoulders are broad and flat, they are of the ſame colour with the head, and are wrinkled on the ſurface. The triangular ſpot between the wings is black and ſhining, the body is of a bright red lead colour on the back, and of a faint duſky brown on the belly, and is compoſed of ſix joints, covered with a ſort of ſcales. The outer wings are very hard and firm, and lie very far over one another; they are opake, and of a dark muddy brown, without any variations: the inner wings are of a duſky white veined with a red-lead colour. The two fore-legs are broader and thicker than the reſt, and end in ſhort blunt claws; theſe the creature never walks with, but always uſes them as arms: the hinder pair are the longeſt, and both they and the middle ones end in a ſharp claw; they are all of a pale brown; and ſomewhat tranſparent. The tail is long and ſtraight; it is compoſed of two ſlender briſtles, of a pale brown; the creature ſcarce ever ſeparates theſe. It lives among the weeds in clear ſtanding waters, and is continually watching for its prey. It feeds on other inſects, and is particularly fond of the cicada aquatica, or worm of the great libella. It ſeizes its prey with the fore-legs, and holds it faſt in them, while the proboſcis pierces into the body, and ſucks the juices.

SCORPION, *Scorpio*, in aſtronomy, the eighth ſign of the zodiac, denoted by the character ♏. See the articles SIGN and ZODIAC.

The ſtars in the conſtellation Scorpio, in Ptolemy's catalogue, are twenty: in Tycho's ten: and in Mr. Flamſteed's forty-nine.

SCORPION, in the antient art of war, an engine chiefly uſed in the defence of the walls of fortified places, by throwing arrows, fire-balls, or great ſtones.

SCORZONERA, VIPER'S-GRASS, in botany, a genus of plants, with a compound imbricated flower, made up of a great many monopetalous, ligulated, and quinquedentated ſmall ones: the ſtamina are five very ſhort capillary filaments: there is no pericarpium, except the imbricated cup, which becomes connivent, and contains a ſingle oblong and ſtriated ſeed after each leſſer flower: the ſeeds are crowned with a plumoſe down.

The roots of this plant abound with a milky juice, of a bitteriſh ſubacrid taſte; and hence may be of ſome ſervice for ſtrengthening the tone of the viſcera, and promoting the fluid ſecretions. They were formerly celebrated as alexipharmics, and for expelling the meaſles and ſmall-pox; but have, of late, almoſt loſt their character in theſe intentions.

SCOTLAND, excluſive of the iſlands, is ſituated between 1° and 6° weſt long. and between 54° 30′ and 58° 30′ north lat. being about three hundred miles long, from north to ſouth, and from fifty to one hundred and fifty miles broad, from eaſt to weſt.

Since the union with England, Scotland is divided into thirty-three ſhires, or counties, which all together ſend only thirty knights to parliament, by reaſon the ſhires of Bute and Cathneſs chooſe only alternately, or every other parliament in their turns; as do thoſe of Cromartie and Nairn, Clacmannan and Kinroſs.

The royal boroughs of Scotland are ſixty-five, but ſo claſſed as to ſend only fifteen burgeſſes to parliament.

New SCOTLAND, *Nova Scotia*, one of the Britiſh colonies in North America, is ſituated between 62° and 72° weſt long. and between 43° and 51° north latitude, being bounded by the river of St. Laurence on the north and north-weſt; by the bay of St. Laurence, and the Atlantic Ocean on the eaſt; by the ſame ocean and New England on the ſouth; and by Canada on the weſt.

SCRAPING, in naval affairs, the act of ſhaving or drawing off with ſcrapers the former cruſt of turpentine, tar, roſin, or ſuch like materials with which a ſhip's-ſide had been covered, to protect the planks from the effects of the ſun and wind. This is generally performed when the ſhip is to be new painted and cleanſed, as at the fitting out for a voyage or expedition, at which time the bottom is alſo cleaned and covered a-new with a coat of ſulphur, tallow, &c. See the article BREAMING.

SCREW, or SCRUE, *Cochlea*, one of the five mechanical powers. A ſcrew is a cylinder cut into ſeveral concave ſurfaces, or rather a channel or groove made in a cylinder, by carrying on two ſpiral planes the whole length of the ſcrew, in ſuch a manner, that they may be always equally inclined to the axis of the cylinder in

their whole progreſs, and alſo always inclined to the baſe of it in the ſame angle.

The ſcrew may alſo be conſidered as a wedge carried round a cylinder, which in that caſe is called the arbor of the ſcrew; the wedge, ſo carried on, making what is called the thread of the ſcrew, as may be ſeen in plate CXIII. *fig.* 1, 2, 3, 4, and 5; the arbor of the ſcrew being A B in *fig.* 1, and *a c b d* in *fig.* 2, as if the cylinder A C B D was inſcribed within the ſcrew. Here, we may ſee the manner how a ſcrew is made; for if it be cut out of the cylinder P H I Q, then H K L M N O P is a ſpiral line going about the cylinder, making the prominent part to be left of the ſaid cylinder, and *h k l m n o*, the line marking the depth to which the ſcrew is to be cut, ſuppoſing the ſame line to go round the inner cylinder or arbor A B C D, though not expreſſed here, to avoid confuſion; and then *h* L *l* N *n*, &c. will repreſent the prominent part or thread of the ſcrew. Now, if inſtead of cutting the hollows H *h* L, L *l* N, N *n* P, &c. into the cylinder P H I Q, a continued wedge be fixed to a ſmaller cylinder, as A C B D, or rather *a c b d*, the ſame kind of ſcrew will be made, and *a b c d* will be the arbor of that ſcrew. Sometimes the moſt prominent part of the thread, as L N, &c. is not ſharp but flat, and then the thread is called a ſquare thread, as in *fig.* 5. which repreſents the ſection of ſuch a ſcrew. This ſort of thread is not uſed in wood, but in iron, and in other metals; it is of good ſervice, being commonly more durable, and raiſing the weight with more eaſe than the ſharp thread.

Force of the SCREW. To make an eſtimate of the force of the ſcrew, which may be compared either to an inclined plane, or to a wedge, according as its arbor does or does not advance in a progreſſive motion whilſt it turns round its axis to raiſe or ſtop a weight, or to preſs bodies together, which are the ſeveral uſes of a ſcrew, let us take a flexible wedge, as, for example, one of paper, and coil it round a cylinder, *fig.* 1. as is repreſented in the figure, where A B is the arbor, C I D one thread or helix, D H E another, and E T G part of the wedge left to ſhew the proportion between the power that turns the ſcrew and the weight W.

If the weight is puſhed up the wedge (or, which is the ſame thing, raiſed perpendicularly by the wedge ſlipping under it) from F to H in the direction W *w*, then will H G be the velocity of the weight, and G T the velocity of the power, which is the caſe of the inclined plane becoming a wedge; and this will be the analogy for the ſcrew thus acting.

As a circle whoſe diameter is H *h*: to H I the diſtance of two threads : : (or as the baſe F G : to the perpendicular H G : :) ſo is the weight : to the power applied to the arbor at A, to raiſe a weight up the thread H D I C.

N. B. We ſuppoſe the diameter of the arbor at A and of the ſcrew at H nearly equal.

This is the caſe of *fig.* 4. where the moveable plank D K is carried down, by turning round the heads G G of the ſcrews A B and C D, in order to preſs ſtrongly the bodies placed between the planks D K and M L, whilſt the piece H I, fixed on the upper plank, is either guided through an hole, or, being only looked at, ſerves to ſhew whether the plank K D be brought down horizontally, as the ſcrews are turned. When long levers are thruſt into the ſquare holes at the heads of the ſcrews, the force of the ſcrew is much increaſed, and then the weight will be to the power : : as the circumference of the circle deſcribed by that part of the lever to which the hand is applied : to the diſtance between two threads. Wherefore, as the circumference of the circle is to the diſtance of two thirds of an endleſs ſcrew :: ſo is the reſiſtance of the teeth of the wheel : to the power applied to the handle.

Archimedes SCREW, in hydraulics, a kind of ſpiral pump, for raiſing water, ſo called from its inventor Archimedes.

It conſiſts of a long cylinder, with a hollow pipe, tube, or groove coiled round it, as repreſented in plate CXIII. *fig.* 7, where A B repreſents the cylinder, and C D the tube open at each end. It is placed in an oblique poſition to the horizon, with the lower end in the water to be pumped away, the other end being ſupported on the lower part of the winch I K, by which the ſcrew and cylinder are turned round.

As ſoon as the ſcrew is immerſed in the water, it immediately riſes therein by the orifice C to the level of the ſurface of the water E F; and if the point of the helix or ſpiral, which in the beginning of the motion is coincident with the ſurface of the water, happens not to be on the lower ſide of the cylinder, the water will, upon the motion of the ſcrew, move on in the ſpiral, till it comes to the point which is on the other ſide, and coincident with the ſurface of the water: when it is arrived at that point, which ſuppoſe at O, it cannot afterwards poſſeſs any other part of the ſpiral than that which is upon the loweſt part of the cylinder; for it cannot move from O towards H or G, becauſe they are ſituated higher above the horizon: and ſince this will conſtantly be the caſe; after the water in the ſpiral has attained the point O, it is plain that it muſt always be on the under ſide of the cylinder.

But becauſe the cylinder is in motion, every part of the ſpiral ſcrew, from O to D, will, by degrees, ſucceed to the ſaid under part of the cylinder; the water, therefore, in the ſpiral, muſt ſucceed to every part thereof, from O to D, as it comes on the lower ſide; that is, it muſt aſcend on the lower part of the cylinder through all the length of the pipe, till it comes to the orifice D, where it will run out, as having nothing farther to ſupport it. Hence it appears how much thoſe gentlemen are miſtaken who, affecting the wonderful, ſay, 'That 'the water aſcends by deſcending;' whereas, if they would have made the moſt of the wonder, they might have truly ſaid, 'That the water aſcends becauſe it can-'not aſcend,' i. e. that it aſcends one way, becauſe it cannot aſcend another; but then the wonder is loſt.

Endleſs or Perpetual SCREW, one ſo fitted in a compound machine, as to turn a dented wheel; ſo called, becauſe it may be turned for ever without coming to an end; plate CXIII. *fig.* 6.

If, in the endleſs, or perpetual-ſcrew, A B, whoſe threads take the teeth of the wheel C D, you take the diſtance of two threads, according to the length of the axis A B; or the diſtance of two teeth in the wheel C D, in the direction of the circumference; and if a weight, W, act at the circumference of the wheel: then if the power D be to the weight W, as that diſtance of the teeth or threads, to the length deſcribed by the power P in one revolution, the power and weight will be in æquilibrio; becauſe in one revolution of P, the wheel D C, with the weight W, has moved only the diſtance of one tooth.

SCRIBE, an officer among the Jews whoſe buſineſs was to write; of which there were three kinds: the firſt and principal of which were the ſcribes of the law, whoſe office was to write and interpret ſcripture; theſe were in great credit and eſteem among the Jews, and had even the precedency of the prieſts and ſacrificers, and their deciſions were received with almoſt the ſame reſpect as the law of God itſelf: the ſecond kind, properly called ſcribes of the people, were a ſort of magiſtrates; and the third were public notaries, or ſecretaries of the council; which were the leaſt conſiderable.

The ſcribes, among the Romans, wrote out decrees, or acts, and made out authentic copies of them.

SCRIBING, in joinery, &c. is a term uſed when one ſide of a piece of ſtuff is to be fitted to another that is irregular. In order to make theſe join cloſe all the way they ſcribe it; that is, they lay the piece to be ſcribed cloſe to the other they intend to ſcribe it to, and opening their compaſſes to the wideſt diſtance theſe two pieces ſtand from each other, they bear the point of one of the legs againſt the ſide they intend to ſcribe to, and with the other point draw a line on the ſtuff to be ſcribed. Thus they form a line on the irregular piece parallel to the edge of the regular one; and if the ſtuff be cut exactly to the line, when theſe pieces are put together they will ſeem a joint.

SCRIPTURE, an appellation given, by way of eminence, to the ſacred and inſpired writings of the Bible. See BIBLE, CANONICAL, &c.

SCRO-

SCROPHULA, in medicine, the king's-evil.

The word is Latin, being a diminutive of *ſcropha*, a ſwine; becauſe that animal is ſaid to be ſubject to ſuch a kind of diſorder.

The cure of this diſeaſe is to be attempted by bleeding, purging, and ſuch medicines as are moſt proper for correcting the viſcidity, ſaltneſs, and acrimony of the humours. The beſt cathartic is dulcified mercury ſix times ſublimed, which ſhould be joined with rhubarb for children; but to adults it may be given alone, with a gentle purging draught ſome hours after it. The next to this in virtue is jalap. And our purging waters are alſo uſeful, as they ſcour the glands, and open the body at the ſame time. In fine, a pill compoſed of mercury ſix times ſublimed, and precipitated ſulphur of antimony, each one grain: of aloes three or four grains made up with the ſyrup of balſam, and taken every night, will be found ſerviceable, not only in this diſeaſe, but in others ariſing from viſcid humours.

The medicines which correct this pravity of the blood and humours, are, for the moſt part, of the diuretic kind, ſuch as burnt ſponge, the diuretic ſalt, and vitriolated tartar; which are the more proper, becauſe they are ſomewhat laxative. To theſe may be added the leſs compound lime-water.

For my part, I have very often experienced the good effects of the following powder, taken twice a day, with three or four glaſſes of the aforeſaid water. Take of burnt ſponge one ſcruple, of purified nitre, coralline, and white ſugar, each ten grains; mix theſe together. *Mead.*

SCROTUM, or SCORTUM, in anatomy, the cutaneous covering of the teſtes outwardly. It is a bag common to both, formed by a continuation of the ſkin of the neighbouring parts, and commonly very uneven, having a great number of rugæ on its outer ſurface. Interiorly it is fleſhy, and forms a muſcular capſula for each teſticle called dartos.

The exterior or cutaneous portion of the ſcrotum is nearly of the ſame ſtructure with the ſkin in general, of which it is a continuation, only it is ſomething finer; and it is likewiſe plentifully ſtored with ſebaceous glands and bulbs, or roots of hairs.

Though it is a common covering for both teſticles, it is, nevertheleſs, diſtinguiſhed into two lateral parts by a ſuperficial and uneven prominent line, which appears like a kind of ſuture, and from thence has been termed raphe.

This line is a continuation of that which divides in the ſame manner the cutaneous covering of the penis; and it is continued through the peritonæum, which it divides, likewiſe, all the way to the anus. It is only ſuperficial, and does not appear on the inſide of the ſkin.

The inner ſurface of the cutaneous bag is lined by a very thin cellular membrane; through which the bulbs and glands appear very diſtinctly, when we view its inſide. The rugæ of the ſcrotum are, in the natural ſtate, commonly a mark of health, and then its ſize is not very large. It increaſes in ſize, principally, according to its length, and then the rugæ diſappear more or leſs, according to the degrees of the preternatural ſtate or indiſpoſition. *Winſlow's Anat.*

SCROWLS, or SCROLLS, in architecture. See VOLUTES.

SCRUPLE, a weight, containing twenty grains, or the third part of a dram. Among goldſmiths it is twenty-four grains.

SCRUPLES *Eclipſed*, in aſtronomy, that part of the moon's diameter which enters the ſhadow, expreſſed in the ſame meaſure wherein the apparent diameter of the moon is expreſſed.

SCRUTINY, a ſtrict examination of the ſeveral votes haſtily taken at an election, in order to diſcover any irregularities committed therein by unqualified voters, &c.

SCUDDING, in navigation, the act of flying before the wind in a great ſtorm.

It is uſual to ſcud under the fore-ſail or fore-top ſail, to guide the fore-part of the ſhip, and prevent her from broaching to; an incident of the moſt dangerous conſequence, and to which ſhe is frequently expoſed in this ſituation. However, when the ſtorm is ſo violent as not to permit her to carry theſe ſails, ſhe may carry a part of the fore-ſail; that is to ſay, the middle of it may be kept faſt to the yard, whilſt the two extremities, or yard-arms are looſed and extended, and this is called ſcudding under her gooſe-wings. If there ſhould be too much wind for this, ſhe muſt go without any ſail, which is termed ſcudding under bare poles.

Scudding is rarely practiſed, but when the ſtate of the ſhip renders it abſolutely neceſſary on account of a leak or ſtrain, or ſome other diſaſter; unleſs, indeed, when the wind which obliges her to ſcud happens to blow directly on the line of her courſe.

SCULPTURE, an art, which, by the means of a deſign or plan, and of ſolid matter, imitates the palpable objects of nature. Its matter is wood, ſtone, marble, ivory; different matters, as gold, ſilver, copper; precious ſtones, as agate and the like. This art includes, alſo, caſting or founding, which is ſubdivided into the art of making figures of wax, and that of caſting them in all ſorts of metals. By ſculpture, we underſtand here all thoſe different ſpecies.

The ſculptors and painters have often had great diſputes amongſt themſelves upon the pre-eminence of their ſeveral profeſſions; the firſt founding the preference upon the duration of their works, and the latter oppoſing them with the effects of the mixture and vivacity of colours. But, without entering into a queſtion not eaſy to decide, ſculpture and painting may be conſidered as two ſiſters that have but one origin, and whoſe advantages ought to be common; we might almoſt ſay, as the ſame art, of which deſign is the ſoul and rule, but which work in a different manner, and upon different materials.

It is difficult, and little important, to trace through the obſcurity of remote ages, the firſt inventors of ſculpture. Its origin may be dated with that of the world, and we may ſay that God was the firſt ſtatuary, when, having created all beings, he ſeemed to redouble his attention in forming the body of man, for the beauty and perfection of which, he ſeems to have wrought with a kind of ſatisfaction and complacency.

The firſt ſculptors made their works of earth, whether they were ſtatues, or moulds and models. This made the ſtatuary Praxiteles ſay, that the works which were either caſt, or cut with a chiſſel or graver, owed their being to the making figures of earth, called plaſtice. It is ſaid, that Demaratus, the father of Tarquinius Priſcus, who took refuge from Corinth in Etruria, brought thither abundance of workmen with him, who excelled in that art, and introduced the taſte for it there, which afterwards communicated itſelf to the reſt of Italy. The ſtatues erected in that country to the gods, were at firſt only of earth; to which for their whole ornament, was added a red colour. We ought not to be aſhamed of the men, ſays Pliny, who adored ſuch gods. They ſet no value upon gold and ſilver, either themſelves or their deities.

We find that the ancients made ſtatues of almoſt all ſorts of wood. There was an image of Apollo at Sicyone made of box. At Epheſus, according to ſome writers, that of Diana was of cedar, as well as the roof of the temple. The lemon-tree, the cypreſs, the palm, the olive, the ebony, the vine, in a word, all trees not ſubject to rot, or to be worm-eaten, were uſed for ſtatues.

Marble ſoon became the moſt uſual and moſt eſteemed material for works of ſculpture. It is believed that Dipænes and Scyllis, both of Crete, were the firſt that uſed it at Sicyone, which was long, in a manner, the center and ſchool of arts: they lived about the 50th Olympiad, a little before Cyrus reigned in Perſia.

Bupalus and Anthermus, two brothers, made themſelves famous for the art of carving marble in the time of Hipponax, that is, in the 60th Olympiad. That poet having a very ugly face, they made his portrait, in order to expoſe it to the laughter of ſpectators. Hipponax conceived a more than poetic fury againſt them, and made ſuch virulent verſes upon them, that, according to ſome, they hanged themſelves through grief and ſhame. But this fact cannot be true, becauſe there were works of their making after that time.

At firſt the artiſts uſed only white marble, brought from the iſle of Paros. It was reported, that in cutting theſe blocks of marble, they ſometimes found natural figures of a Silenus, a god Pan, a whale, and other fiſhes. Jaſper, and ſpotted marble, became afterwards the faſhion. It was brought principally from the quarries of Chio: and ſoon was commonly found in almoſt all countries.

It is believed that the manner of cutting large blocks of marble into many thin pieces, to cover the walls of houſes, was invented in Cairo. The palace of king Mauſolus, at Halicarnaſſus, is the moſt ancient houſe that had theſe incruſtations of marble, which were one of its greateſt ornaments.

The uſe of ivory, in works of ſculpture, was known from the earlieſt ages of Greece. Homer ſpeaks of them, though he never mentions elephants.

The art of caſting gold and ſilver is of the greateſt antiquity, and cannot be traced to its origin. The gods of Laban, which Rachel ſtole, ſeem to have been of this kind. The jewels offered to Rebecca were of caſt gold. Before the Iſraelites left Egypt, they had ſeen caſt ſtatues, which they imitated in caſting the golden calf, as they did, afterwards, in the brazen ſerpent. From that time all the nations of the Eaſt caſt their gods, *deos conflatiles*, and God forbad his people to imitate them upon pain of death. In the building of the Tabernacle, the workmen did not invent the art of founding. God, only, directed their taſte. It is ſaid that Solomon cauſed the figures uſed in the Temple, and elſewhere, to be caſt near Jericho, becauſe it was a clayey ſoil, which ſhews that they had even then the ſame manner of founding great maſſes as we have.

It were to be wiſhed that the Greek and Roman authors had informed us in what manner the ancients caſt their metals, in making figures. We find, by what Pliny writes on that head, that they ſometimes made uſe of ſtone moulds. Vitruvius ſpeaks of a kind of ſtones found about the lake Volſenus, and in other parts of Italy, which would bear the force of fire without breaking, and of which moulds were made for caſting ſeveral ſorts of works. The ancients had the art of mingling different metals in the mould, to expreſs different paſſions and ſentiments by the diverſity of colours.

There are ſeveral ways of carving metals and precious ſtones: for in both the one and the other they work in relief, and in hollow, which is called engraving. The ancients excelled in both ways. The baſſo relievo's which we have of theirs, are, by good judges, infinitely eſteemed: and as to engraved ſtones, as the fine agates and cryſtals, of which there are abundance in the king of France's cabinet, it is generally ſaid, that there is nothing ſo exquiſite as thoſe remains of the ancient maſters.

Though they engraved upon almoſt all kinds of precious ſtones, the moſt finiſhed figures which we have of theirs are cut upon onyxes, a kind of agate not tranſparent; or on cornelians, which they found more fit for engraving than any other ſtones, being more firm and even, and cut more neatly; and, alſo, becauſe there are different colours that run one above another in the onyx, by the means of which, in relievo, the bottom continues of one colour, and the figures of another. To engrave upon gems and cryſtals, they uſed, as now, the point of a diamond.

The ancients highly extolled the gem in the ring of Polycrates, tyrant of Samos, which he threw into the ſea, and was brought back to him by a very extraordinary accident: in Pliny's time it was pretended to be at Rome. It was, according to ſome, a ſardonyx, to others an emerald. That of Pyrrhus was no leſs eſteemed; upon which might be ſeen Apollo with his harp and the nine muſes, each with their peculiar ſymbol: and all this not the effect of art but of nature.

The art of ſculpture was principally employed upon cups uſed at feaſts: theſe pieces were very rich and curious, as well as of the moſt coſtly materials.

One of the greateſt advantages the art of making portraits ever received for the eternizing its works, is that of engraving upon wood and copper plates, by the means of which a number of prints are taken off, that multiply a deſign almoſt to infinity, and convey the artiſt's thoughts into the different parts, which before could only be known from the ſingle piece of his own work. There is reaſon to wonder, that the ancients, who engraved ſo many excellent things upon hard ſtones and cryſtals, did not diſcover ſo fine a ſecret, which, indeed, did not appear till after printing, and was, no doubt, an effect and imitation of it; for the impreſſion of figures and cuts did not begin to be uſed till the end of the fourteenth century. The world is indebted for the invention of them to a goldſmith, that worked at Florence. See ENGRAVING.

SCUPPERS, in ſhip-building, ſmall channels cut through the ſhip's-ſide, with a gradual ſlope from the decks. They are uſed to carry off the water which may lie on the deck; for which purpoſe there is frequently a leathern pipe nailed on the out ſide all round the ſcupper-hole, to carry the water down without ſtaining or dirtying the veſſel's ſide. Theſe are termed ſcupper-holes.

SCURRA, in ornithology, the name by which the antients called the jackdaw.

SCURVY, *Scorbutus*, a name given by medicinal writers to a diſeaſe ſo various and different in appearance, that it does not ſeem to be one and the ſame diſtemper. In the northern countries it has always been common, and the nearer they are to the ſea, the more ſevere it proves: Accordingly the Danes, Norwegians, and other inhabitants of the coaſts of the Baltic, are vaſtly afflicted with it; nor do the Germans, Dutch, or our own countrymen, eſcape its fury.

It begins by foul ulcers in the mouth and legs, whence it is called ſtomacace and ſceletyrbe by Pliny, who imputes it to the bad qualities of water, and ſays, that the herba Britannica, which is believed to be the hydrolapathum nigrum of Muntingius, or great water-dock, was found to be its cure. But the diſeaſe was known long before Pliny's time: for Hippocrates deſcribes it by the name of σπλην μεγας, or great ſpleen; and ſays, likewiſe, that it ariſes from drinking cold, crude, turbid waters.

I remember to have formerly ſeen, in St. Thomas's hoſpital, an inſtance of this caſe in a country fellow of the iſle of Sheppy; which place is notorious for moiſt thick air, and unwholeſome water. When the Roman army, under the command of Claudius, landed in Britain, and the troops were ſtationed in the abovementioned iſland and places adjacent, they there contracted this diſeaſe; and it is not improbable that ſome of the natives ſhewed them the herb which Pliny ſays was of ſervice to them, and that the Romans gave it the name of herba Britannica, from the country; for it is well known that that emperor embarked his army for that expedition at Boulogne, which is directly oppoſite to Kent. Strabo relates a ſimilar ſtory of the Roman army, which Auguſtus ſent into Arabia under the command of Ælius Gallus: for, he ſays, that while they were at Albus Pagus, the ſoldiers were ſeized with diſorders of the mouth and legs, called ſtomacace and ſceletyrbe, which are an endemic in that country, and are a ſort of relaxation proceeding from the waters and vegetables. Now to me it is very plain that the unwholeſome ſea air, bad diet, and worſe water, rendered that climate ſubject to thoſe diſorders; for Ptolemy, in his Geography, places Albus Pagus on the coaſt of the Sinus Arabicus, or Red Sea. But to return from this digreſſion: The poor patient had an irregular intermitting fever, with a bad habit of body; and, likewiſe, an ill-natured ulcer in each of his legs. By the uſe of medicines proper for the ſcurvy, I mean bitters and diuretics, he ſeemed to grow better, for one of the ulcers was, by chirurgical applications, entirely healed; but while the other was under cure, a gangrene ſeized the part unexpectedly; which, being ſcarified, in order to check its progreſs, the patient died ſuddenly. Upon opening the abdomen, we were ſtruck with amazement at the monſtrous ſize of the ſpleen; for it weighed five pounds and a quarter, whereas the liver weighed but four and a quarter. But its bulk ſeemed to be its only defect: for it retained its natural ſhape and colour, and had not the leaſt ſcirrhoſity or other hardneſs: and its inſide was, as uſual, of a dark livid hue, with lax fibres, and deep-coloured blood. From the above-mentioned

ulcers the breath becomes offenſive, the gums are corrupted and turn livid, and ſometimes blackiſh, and upon preſſing then lightly with the finger, they emit a duſky gore: beſides, they are ſo lax and flabby, that they quit their hold of the teeth; and theſe are ſometimes ſo looſe, that they may all be pulled out with great eaſe. In the mean time greeniſh and livid ſpots, like the remains of ecchymoſes, appear on various parts of the body, as on the arms, buttocks, thighs, legs, and frequently all over the ſkin, ſo as to make it have the appearance of a jaundice. The patient is alſo tortured with ſevere gripings. And from this ſymptom it is that the diſeaſe has obtained its name, being derived from the Saxon word ſcherbock, or ſcherbuck, which ſignifies tearings of the belly.

Beſides unwholeſome waters, medical writers attribute the diſeaſe partly to ſalted proviſions and pulſe; which, as they are of different concoction, furniſh the body with groſs and improper nutriment. But they ſeem not to have ſufficiently attended to a more univerſal cauſe, I mean, bad air, which, taken into the lungs, is very prejudicial. This is particularly manifeſt in long voyages, in which the ſailors are moſt ſeverely afflicted with this diſtemper, of which we have a remarkable and moving account in the hiſtory of lord Anſon's expedition to the South Seas, in which that great commander loſt near one third part of his men by this cruel enemy; and the calamity roſe to ſuch a high pitch, that the callus of broken bones, which had been completely formed for a long time, was found diſſolved, and the fracture ſeemed as if it had never been conſolidated. Wherefore, in theſe caſes, there muſt certainly be a high degree of putrefaction; and the blood becomes ſo foul a mixture, that whenſoever it be drawn, it has nothing of its natural red colour, but reſembles a dark muddy puddle. Now, as to the manner in which the cauſes abovementioned corrupt and putrify the humours, it will be eaſily found by thoſe who are well acquainted with the proportion and laws of motion in the animal machine.

With regard to the cure, it is much eaſier to prevent the ſcurvy than to remove it; for, when it has once taken root in the body, it is very difficult to drive it out by medicines. Now, its beſt remedy is good wholeſome air and proper diet; wherefore, as ſoon as a perſon is taken ill, if he be at ſea, he ought to alter his ſituation as ſoon as poſſible and get aſhore, to breathe the land air; but, if on land, he ſhould go into the country for the benefit of purer open air. And in both caſes, what fleſh he eats ſhould be freſh and tender; but the greateſt part of his food ought to be vegetables, both ſuch as abound in volatile ſalt, as ſcurvy-graſs, creſſes, brook-lime, and the like; and thoſe which are of a cooling nature, as ſorrel, endive, lettuce, purſlain, and others of this kind. And it will often be beneficial to eat all theſe, or ſome of each ſort, promiſcuouſly together. But the greateſt ſervice may be expected from ſubacid fruits, as lemons, oranges, and pomegranates, eaten frequently upon account of their cooling and ſubaſtringent quality. *Mead's Monita & Precepta.*

SCURVY-GRASS, *cochlearia*, in botany. See the article COCHLEARIA.

SCUTAGE was antiently a tax impoſed on ſuch as held lands, &c. by knight's ſervice, towards furniſhing the king's army: hence ſcutagio habendo was a writ that lay for the king, or other lord, againſt tenants holding by knight's ſervice, to ſerve in perſon, or ſend a ſufficient man in their room, or pay a certain ſum, &c.

SCUTIFORME Os, in anatomy, the chief bone of the knee, called alſo patella, mola, &c. See the article PATELLA.

SCUTIFORMIS CARTILAGO, in anatomy, one of the cartilages of the larynx, the broadeſt and biggeſt of them all, called alſo thyroides. See LARYNX.

This cartilage is of a quadrangular figure, and ſtands in the anterior part, where the pomum Adami makes its prominence, whence it is ſometimes called the anterior cartilage. It is gibbous without-ſide, and hollow within; ſometimes double, chiefly in women, in whom it does not advance ſo far forward as in men.

SCUTTLE, in ſhip-building, a ſort of ſmall ſquare hole, cut through the decks or hatch-coverings of a ſhip to paſs up and down through. See the article HATCH-WAY.

SCYTALA, in mechanics, a term uſed by ſome writers, for a kind of radius, or ſpoke, ſtanding out from the axis of a machine, as an handle or lever to turn it round and work it by.

SCYTALA LACONICA, a ſtratagem or device of the Lacedemonians, for the ſecret writing of letters to their correſpondents, ſo that if they ſhould chance to be intercepted, nobody might be able to read them. To this end they had two wooden rollers or cylinders, perfectly alike and equal, one whereof was kept in the city; and another by the perſon to whom the letter was directed. For the letter, a ſkin of a very thin parchment was wrapped round the roller, and thereon was the matter written; which done, it was taken off, and ſent away to the party, who upon putting it in the ſame manner upon his roller, found the lines and words in the very ſame diſpoſition as when they were firſt written.

SEA, *Mare*, in geography, is frequently uſed to ſignify that vaſt body of water encompaſſing the whole earth, more properly called ocean.

Sea is more properly uſed for a particular part or diviſion of the ocean; denominated from the country it waſhes, or other circumſtances. As the Iriſh Sea, Mediterranean Sea, Baltic Sea, North Sea, Red Sea, &c.

The ſea differs in ſaltneſs in different parts; it is in general obſerved, that in the hotteſt climates the water is ſalteſt.

When ſalt water freezes, it hath been thought to let fall all its ſalt; the ice of ſea water, and the water melted from it, taſting freſh, and being good for boiling meat and peaſe in. Captain Middleton, being in Hudſon's Streights in July 1738, took ice from under the ſurface of the ſea, which he melted till he got forty quarts of water; theſe he evaporated to dryneſs, and out of that quantity had only ſix ounces of ſalt, or about $\frac{1}{113}$. *Phil. Tranſ.* N°. 461.

General Motion of the SEA. Mr. Daſſie of Paris, in a work publiſhed about ſixty years ago, has been at great pains to prove that the ſea has a general motion, independent of winds and tides, and of more conſequence in navigation than is uſually ſuppoſed. He affirms that this motion is from eaſt to weſt, inclining towards the north, when the ſun has paſſed the equinoctial northward, and that during the time the ſun is in the northern ſigns; but the contrary way, after the ſun has paſſed the ſaid equinoctial ſouthward; adding, that, when this general motion is changed, the diurnal flux is changed alſo: whence it happens, that in ſeveral places the tides come in during one part of the year, and go out during the other; as on the coaſts of Norway, in the Indies, at Goa, Cochinchina, &c. where, while the ſun is in the ſummer ſigns, the ſea runs to the ſhore; when in the winter ſigns, from it. On the moſt ſouthern coaſts of Tonquin and China, for the ſix ſummer months, the diurnal courſe runs from the north with the ocean; but, the ſun having repaſſed the line toward the ſouth, the courſe declines alſo ſouthward. *Philoſ. Tranſact.* N°. 135.

Baſon of the SEA, *Fundus Maris*, a term uſed by geographers, and other writers, to expreſs the bottom of the ſea in general.

Our honourable Mr. Boyle is the firſt who has written any thing on that part of the globe, and he has given us a treatiſe expreſsly upon it; but this only gives an account of its irregularities, and unequal depths, and is founded on the obſervations communicated to him by mariners, and people of too little curioſity to be depended upon for great diſcoveries.

The ingenious Count Marſigli has, ſince his time, given us a much fuller account of this part of the globe, in a great part from his own experiments in many places, particularly along the coaſts of Provence and Languedoc.

The entire baſon of the ſea is of ſuch immenſe extent, and covered in many places with ſuch an unfathomable depth of water, that it is not to be expected that it can be traced in every part; but as the whole may be gueſſed at, from ſome part of it, and as its general figure is of no conſequence in a ſearch of this kind, the obſervations of

this curious author are of great value, in forming a judgment of the whole.

The materials which compoſe the bottom of the ſea, may very rationally be ſuppoſed, in ſome degree, to influence the taſte of its waters: and Marſigli has made many experiments to prove, that foſſil coal, and other bituminous ſubſtances, which are found in plenty at the bottom of the ſea, may communicate in great part its bitterneſs to it. We are not, however, to judge haſtily, that there are not ſo many beds of theſe at the bottom of the ſea, as would be neceſſary for ſuch a purpoſe, or to judge too haſtily againſt the exiſtence of any other ſubſtances there, becauſe we do not find proofs of them by the plummet, which in ſounding brings up other ſubſtances, and not theſe; for the true bottom of the ſea is very often covered and obſcured from us by another accidental bottom, formed of various ſubſtances mingled together, and often covering it to a conſiderable depth.

The entire gulf of Lyons, ſituated between Cape Quiez in Rouſillon, and Cape Croiſit in Provence, forms a bank above the ſurface of the water at the ſhore, of the exact and perfect figure of an arch; and within this there is formed another ſuch arch, making the bottom of the ſea in that place for a very great way from ſhore, which is of different depths in various places, but uſually between ſixty and ſeventy fathoms.

It is a general rule among ſailors, and is found to hold true in a great many inſtances, that the more the ſhores of any place are ſteep and high, forming perpendicular cliffs, the more deep the ſea is below; and that, on the contrary, level ſhores denote ſhallow ſeas. Thus the deepeſt part of the Mediterranean is generally allowed to be under the height of Malta. The obſervation of the ſtrata of earth, and other foſſils, on and near the ſhores, may ſerve to form a very good judgment, as to the materials which are found in its bottom. The veins of ſalt and of bitumen doubtleſs run on the ſame, and in the ſame order in which we ſee them at land; and the ſtrata of rocks, that ſerve to ſupport the earth of hills and elevated places on ſhore, ſerve alſo, in the ſame continued chain, to ſupport the immenſe quantity of water in the baſon of the ſea. It is probable alſo that the veins of metals, and of other mineral ſubſtances, which are found in the neighbouring earth, are in the ſame manner continued into the depths of the ſea. The particles of metals, in this caſe, are probably carried off into deep water, and ſunk among the ſofter matter of the bottom; but ſome of the lighter minerals ſeem to have given colour to thoſe beautiful cruſts, which are found upon many ſea plants, and which loſe their luſtre in the drying. The ſubterranean rivers, and currents of water, make great changes in what would be the natural ſurface of the bottom of the ſea, where they ariſe, each having a peculiar baſon of its own. We are informed by numerous inſtances of ſubterranean currents, and, as we ſee them break out in rivers on the ſurface of the earth in ſome parts, ſo in others we may be well aſſured that they break up the bottom of the ſea, and empty their freſh waters into the ſalt maſs.

In this caſe, the ruſhing up continually of ſuch a body of water makes a roundiſh cavity, and its running ſome one way lengthens and carries on that cavity, till by degrees it is loſt, as the freſh water by degrees becomes blended with the ſalt. Thus every river, that ariſes in the bottom of the ſea, alters the form of its ſurface, and makes a baſon for itſelf, in which it runs a conſiderable way. Many ſeas near the ſhore, and when the water is tolerably clear, ſhew the traces of theſe currents to the naked eye from the ſurface, and the water taken up from them is found more or leſs freſh. The coral fiſheries have given us occaſion to obſerve, that there are many, and thoſe very large, caverns or hollows in the bottom of the ſea, eſpecially when it is rocky; and that the like caverns are ſometimes found in the perpendicular rocks, which form the ſteep ſides of thoſe fiſheries. Theſe caverns are often of great depths, as well as extent, and have ſometimes wide mouths, equal to their largeſt diameter in any part, but ſometimes they have only narrow entrances into large and ſpacious hollows. It is the common opinion of the people about the place, that theſe caverns are prepared by nature for the circulating of the ſea water; but that operation, however neceſſary, may be performed as well without, as with theſe caverns, and they ſeem in reality to be only accidental.

We daily meet with immenſe hollows and caverns, naturally made in rocky mountains; and as this part of the bottom of the ſea is almoſt all rock, and its ſides of the ſame nature, it is no wonder that the ſame accidents ſhould happen, and like hollows be found, though with no particular intent of Providence in their uſe. Nay there is this farther reaſon to expect them in the rocks buried under the ſea than in thoſe in hills, that the latter are in a ſtate of reſt and quiet, whereas the former are in continual reach of water, which will inſinuate itſelf into every crack or crevice nature has left in them, and may be eaſily ſuppoſed to have burrowed its way in a ſmall hole made by nature, till it has formed of it a very large one.

It ſeems plain from the whole, that the baſon of the ſea was at the creation, or at its ſecond formation after the univerſal deluge, covered with, or compoſed of the ſame ſubſtances, as the ſurface of the reſt of the earth is, that is, of rocks, clay, and ſand, and other ſuch ſubſtances. The common obſervations of ſeamen ſeem indeed to make againſt this opinion, but they may be eaſily ſolved, ſo as not to overthrow it. The plummet which they let down in ſounding, uſually brings up with it a matter compoſed of mud, tartarous incruſtations, or of dead weeds and broken ſhells, or numbers of various bodies of this kind, cemented together into a firm maſs by ſome ſparry or tartarous matter, depoſited from among the water, and agglutinating them together: theſe form an artificial bottom, covering the natural one; but it is eaſy to ſee, that ſuch a cruſt or coat as this muſt needs have been formed over the true bottom, in places where numbers of animals and vegetables are produced, and decay again, and where the waters being at reſt have time to depoſit their ſtony matter, in the ſame manner as the waters of ſeveral of our petrifying, or rather incruſtating ſprings do. And that theſe decayed ſubſtances, and this ſtony matter, falling to the bottom together, and there lying undiſturbed, muſt neceſſarily have formed juſt ſuch a cruſt as is found; and the natural bottom of the ſea, whether of ſtone, of ſand, or of clay, muſt be covered by ſuch accidental concretions, and that probably to ſuch a depth, that it is not eaſy now to break through it. There are places however where, by ſome accidents, this ſort of adventitious cruſt either has never been formed, or elſe has been removed. In theſe places we find the natural bottom, as deſcribed, that is, of the ſame nature with the ſtrata in the body of the earth. The ſimile the Count Marſigli has made, between the baſon of the ſea and a caſk of wine, is very expreſſive and juſt. When wine has been a long time kept in a caſk, the whole internal ſurface of that caſk is ſo covered and incruſtated over with tartar, that it ſeems within to be really compoſed of it; yet, as we know that this caſk is of wood, we are very certain that the true inner ſurface of it is of the ſame texture and nature with the tree from which it was cut, though we cannot get off the accidental ſurface formed by the liquor kept in it, and wholly covering it.

We very frequently meet with fine and pure ſand at the bottom of the ſea, and in theſe places are apt to believe that we certainly have the true and original bottom, but this is rather to be looked on as a probability than a certainty; and, where the ſand is more than ordinarily fine, there is always reaſon to ſuſpect that the courſe of ſome ſubterranean river has brought it there, by opening into the ſea in this part; and that this is one of thoſe particular baſons, which theſe rivers form to themſelves within the baſon of the ſea, and which continue only to a ſmall diſtance from their ſource.

The bottom of the ſea is covered with a variety of matters, ſuch as could not be imagined by any but thoſe who have examined into it, eſpecially in deep water, where the ſurface only is diſturbed by tide and ſtorms, the lower part, and conſequently its bed at the bottom, remaining for ages perhaps undiſturbed. The ſoundings, when the plummet firſt touches ground on approaching the ſhores, gives ſome idea of this. The bottom of the plummet is hollowed, and in that hollow there is placed a lump of tallow; this, being at the bottom

tom of the lead, is what firſt touches ground, and the ſoft nature of this fat receives into it ſome part of thoſe ſubſtances, which it meets with at the bottom: this matter, thus brought up, is ſometimes pure ſand, ſometimes a ſort of ſand made of the fragments of ſhells, beat to a ſort of powder; ſometimes it is made of a like powder of the ſeveral ſorts of corals, and ſometimes it is compoſed of fragments of rocks: but beſides theſe appearances, which are natural enough, and are what might very well be expected, it brings up ſubſtances which are of the moſt beautiful colours. Things of as fine a ſcarlet, vermillion, purple, &c. as the fineſt paint could make them, and as yellow as a ſolution of gamboge, are common; and ſometimes, though not ſo frequently, the matter brought up is blue, green, or of a pure ſnowy whiteneſs. Theſe coloured matters ſometimes ſeem to have made up the whole bottom or maſs of the ſurface, but more uſually they have been formed upon other things, as upon the mud, or upon larger pieces of ſhells, corals, and the like, in the manner of tartarous cruſts, and thoſe in ſome degree reſembling the cruſtaceous coats of ſome of the ſea plants. The colours of theſe ſubſtances are not merely ſuperficial and tranſient, but many of them are ſo real and permanent, that they may be received into white wax melted, and poured upon them, or kept in fuſion about them; and, when thus examined, they ſeem as if a proper care might make them of great value, as paints of the finer kinds, where little is to be uſed.

The ſame coloured matters that thus coat the ſubſtances, found at the bottom of the ſea in theſe places, are alſo ſometimes found extended over the ſurface of ſea plants of the harder kind, which grow in deep water. They are always, in this caſe, in a ſort of liquid form, being lodged within, or embodied among a ſort of jelly or glue of a tranſparent ſubſtance, which in theſe caſes perfectly coats over the whole plant. In this ſtate it gives the naturaliſt, who is preſent at the fiſhing up his treaſures, a tranſient proſpect of a very elegant kind; but this vaniſhes, while he admires it. A piece of coral, or other hard ſea plant, thus coated over, appears, as it riſes to the ſurface of the water, of a delicate green, blue, or purple; but, when taken above water, it is found that this fine colour is only in the coat of glue or jelly which covers the plant: as ſoon as this is wiped off, the colour is carried away with it, and the coral ſhews its own native tinge; and it is to no purpoſe to attempt the preſerving it, by ſuffering this glue to dry upon the plant, for the colour flies away by degrees, as the moiſture evaporates; and the coral or plant, whatever it be, is only ſo much the leſs beautiful, than it naturally would have been, as it is covered with a dry yellowiſh dirty-looking horny matter. Theſe are beauties in the ſubmarine plants, therefore, which can be only ſeen by thoſe who venture out, in order to take them up.

The ſmall quantities of theſe elegant colours, which we thus find ſpread over the ſurfaces of plants and other bodies, as we approach deep water, may give a rational idea of what we ſhould find, were we able to examine the bottoms of the ſea in its deep and unfathomable receſſes. It is eaſy to conceive, that in theſe places we ſhould find great quantities of the moſt beautiful ſubſtances. *Marſigli, Hiſt. Phyſ. de la Mer.*

SEA *Breaches*, a term uſed by the farmers to expreſs the over-flowing of their low lands near the ſea by the ſea water.

Sea ſalt, moderately uſed, is a great improvement to all lands, but too much of it kills all ſorts of vegetables, except ſuch as nature has intended to live among it. The ſea, breaking in upon lands thus, injures them greatly. The owner is to ſtop the breach by which it entered with all poſſible diligence, and then trenches and drains muſt be cut through all parts of the land, to carry the ſalt water into ſome one low place, from which it may be emptied by means of an engine; or, if it be ſmall in quantity, it may be laded out by hand over the bank; or, if yet leſs, the ſun and winds may dry it away: but, in either caſe, the place where it was ſuffered to reſt muſt be covered with a large quantity of freſh earth, to take off from the too great ſaltneſs of the other; and the whole land ſhould be plowed for three or four years, to let in the rains and air to freſhen it. *Mortimer's Husb.*

SEAL, *Sigillum*, a puncheon, or piece of metal, or other matter, uſually either round or oval, whereon are engraven the arms, device, &c. of ſome prince, ſtate, community, magiſtrate, or private perſon, often with a legend or ſubſcription, the impreſſion whereof, in wax, ſerves to make acts, inſtruments, &c. authentic.

Before the time of William the Conqueror, the makers of all deeds only ſubſcribed their names, adding the ſign of the croſs, and a great number of witneſſes; but that monarch, and the nobility, uſed ſeals with their arms on them, which example was afterwards followed by others. The colour of the wax wherewith this king's grants were ſealed was uſually green, to ſignify that the act continued freſh for ever, and of force.

A ſeal is abſolutely neceſſary in reſpect of deeds, becauſe the ſealing of them makes perſons parties thereto, and without being ſealed, they are void in law. It is held, that if a ſeal be broken off, it will render the deed void, and that where ſeveral are bound in a bond, the pulling off the ſeal of one vacates it as to all the reſt.

The king's great ſeal is that whereby all patents, commiſſions, warrants, &c. coming from the king are ſealed. The keeping hereof is in the hands of the lord high-chancellor, who is hence denominated lord keeper. Indeed there is ſome difference between the lord chancellor and lord keeper, not in office, but in the manner of creation, the latter being made by the delivery of the great ſeal to him by the king, but the former having a patent. The king's privy ſeal is a ſeal that is uſually firſt ſet to grants that are to paſs the great ſeal. See the article KEEPER.

SEAL is alſo uſed for the wax or lead, and the impreſſion thereon, affixed to the thing ſealed.

SEALER, an officer in chancery, appointed by the lord chancellor or keeper of the great ſeal, to ſeal the writs and inſtruments there made in his preſence.

SEALING, in architecture, the fixing a piece of wood or iron in a wall with plaſter, mortar, cement, lead, and other ſolid binding. For ſtaples, hinges, and joints, plaſter is very proper.

SEALING-WAX. See the article WAX.

SEAM or SEME *of Corn*, is a meaſure of eight buſhels.

SEAM *of Glaſs*, the quantity of 120 pounds, or 24 ſtones, each five pounds weight. The ſeam of wood is an horſe load.

SEAMS, in ſhip-building, the interſtices between the planks in a ſhip's decks, ſides, or bottom: they are filled with a quantity of oakum, or old ropes untwiſted and drawn aſunder, after which they are covered with hot melted pitch, to prevent the entrance of the water. See CAULKING.

SEAR-CLOTH, or CERE-CLOTH, in ſurgery, a form of external remedy ſomewhat harder than an unguent, yet ſofter than an emplaſter, though it is frequently uſed both for the one and the other. The ſear-cloth is always ſuppoſed to have wax in its compoſition, which diſtinguiſhes and even denominates it. In effect, when a liniment or unguent has wax enough in it, it does not differ from a ſear-cloth. Sear-cloths are a kind of ſubſtitutes to friction, and are ſometimes uſed for other purpoſes: the beſt are compounded of reſolvent drugs, as ſaffron, myrrh, and aloes, incorporated with wax and gums, as galbanum, gum ammoniac, and ſagapenum, the whole tempered with wine.

SEASONS, in coſmography, certain portions or quarters of the year, diſtinguiſhed by the ſigns which the earth then enters, or by the meridian altitudes of the ſun, conſequent on which are different temperatures of the air, different works in tillage, &c. The year is divided into four ſeaſons, ſpring, ſummer, autumn, and winter. The beginnings and endings of each whereof, ſee under its proper article, SPRING, &c.

SEBUÆI, a ſect among the ancient Samaritans; whom St. Epiphanius accuſes of changing the time expreſſed in the law, for the celebration of the great annual feaſts of the Jews. Serrarius conjectures, that they were thus called, from their celebrating the feaſt of the paſſover on the ſeventh month, called by the Hebrews ſeba, ſeventh.— Druſius rather takes them to have

been denominated from Sebaia, the leader of a ſect among the Samaritans; as the followers of Doſitheus were denominated Doſithei; which two ſects ſome Jewiſh doctors ſuppoſe to have ſubſiſted at the ſame time.—Scaliger derives the name from the Hebrew ſebua, week; as who ſhould ſay, Hebdomadites, becauſe of their celebrating every ſecond day of the ſeven weeks, between Eaſter and Whitſuntide. Yet the ſame Scaliger, in his anſwer to Serrarius, gives a different explication.—In effect, all that has hitherto been advanced on the point, is mere conjecture.

SEBURAI, SEBURÆI, a name which the Jews give to ſuch of their rabbins or doctors, as lived and taught ſome time after the finiſhing of the Talmud.

The word is derived from סבר, *ſebar*, I think, whence סברא, *ſebura*, opinion, ſentiment; and thence סבראי, *ſeburi*, or *ſeburai*, opinionative.

The reaſon of this appellation, ſay the rabbins, is, that the Talmud being finiſhed, publiſhed, and received in all the ſchools and ſynagogues, theſe doctors had nothing to do, but diſpute for, and againſt, the Talmud and its deciſions. Others ſay, it was becauſe their ſentiments were not received as laws, or deciſions, as thoſe of the Miſchnic and Gemaric doctors were; but were held as mere opinions. Others, as the author of Scalſcheleth Hakkabala, or Chain of Tradition, tell us, that the perſecution the Jews underwent in thoſe times, not allowing them to teach quietly in their academies, they only propoſed their opinions on the compoſition of the Miſchna.

The firſt and chief of the Seburai was R. Joſi, who began to teach in the year 787 of the æra of contracts; which, according to R. David Gautz, falls on the year of the world 4236; and who, according to R. Abraham, was 38 years preſident of the Jewiſh academy.

This æra of contracts is the ſame with that of the Seleucidæ, the 787th year whereof falls on the year of Chriſt 476, which, of conſequence, is the æra of the origin of the Seburai; whoſe reign did not hold long: Buxtorf ſays, not above ſixty years; but R. Abraham, and others, not fifty. The laſt of them was R. Simona. They were ſucceeded by the Gaons of Geonim.

SECALE, or SECALINA, RYE. See the article RYE.

SECANT, in geometry, is a line that cuts another, or divides it into two parts.

Thus the line A M (plate CXIII. *fig.* 8.) is a ſecant of the circle A E D, &c. as it cuts it in B.

It is demonſtrated by geometers, 1. That if ſeveral ſecants M A, M N, M E, &c. be drawn from the ſame point M, that paſſing through the center M A is the greateſt, and the reſt are all ſo much the leſs as they are more remote from the center. On the contrary, the portions thereof without the circle M D, M O, M B, are ſo much the greater as they are farther from the center. 2. That if two ſecants, M A and M E, be drawn from the ſame point M, the ſecant M A will be to M E as M D to M B. See the article TANGENT.

In trigonometry, the ſecant denotes a right line drawn from the center of a circle, which cutting the circumference, proceeds till it meets with a tangent to the ſame circle: thus the line F C drawn from the center C till it meet the tangent E F, is called a ſecant; and particularly the ſecant of the arch A E, to which E F is a tangent. The ſecant of the arch A H, which is the complement of the former arch to a quadrant, is called the co-ſecant, or ſecant of the complement.

SECOND, in geometry, chronology, &c. the ſixtieth part of a prime or minute, whether of a degree, or of an hour; it is denoted by two ſmall accents, thus (″).

SECOND, in muſic, one of the muſical intervals; being only the difference between any ſound, and the next neareſt ſound, whether above or below it.

As in the compaſs of a tone ſome reckon nine ſenſible ſounds, and others ten, which form the intervals called commas; ſo there are eight kinds of ſeconds according to the former opinion, and nine according to the latter. However, in practice, they uſually diſtinguiſh only four ſorts. 1. That called a diminiſhed ſecond, containing four commas; being the difference, for inſtance, of a natural *ut*, and an *ut* ſharp. 2. That called a ſecond minor, or imperfect ſecond, containing five commas, viz. from *mi* to *fa*; or from *la* to B *mol*; or from *fa* ſharp to *ſol*. 3. A major ſecond, called by the Italians a perfect ſecond, containing nine commas. 4. A redundant ſecond, compoſed of a whole tone, and a minor ſemi-tone.

SECONDARY, in general, ſomething that acts as ſecond, or in ſubordination to another.

Secondary circles of the ſphere, are circles paſſing through the poles of ſome great circle: thus the meridians and hour-circles are ſecondaries to the equinoctial. There are alſo ſecondaries paſſing through the poles of the ecliptic, by means of which all ſtars are referred to the ecliptic. See the articles ECLIPTIC, LONGITUDE, SPHERE, &c.

SECRETARY, an officer who by his maſter's orders writes letters, diſpatches, and other inſtruments, which he renders authentic by his ſignet. Of theſe there are ſeveral kinds; as, 1. Secretaries of ſtate, who are officers that have under their management and direction the moſt important affairs of the kingdom, and are obliged conſtantly to attend on the king: they receive and diſpatch whatever comes to their hands, either from the crown, the church, the army, private grants, pardons, diſpenſations, &c. as likewiſe petitions to the ſovereign; which when read, are returned to them; all which they diſpatch according to the king's direction. They have authority to commit perſons for treaſon, and other offences againſt the ſtate, as conſervators of the peace at common law, or as juſtices of the peace throughout the kingdom. They are members of the privy-council, which is ſeldom or never held without one of them being preſent; and as to the buſineſs and correſpondence in all parts of this kingdom, it is managed by either of the ſecretaries without any diſtinction; but with reſpect to foreign affairs, the buſineſs is divided into two provinces or departments, the ſouthern and the northern, comprehending all the kingdoms and ſtates that have any intercourſe with Great Britain; each ſecretary receiving all letters and addreſſes from, and making all diſpatches to, the ſeveral princes and ſtates comprehended in his province: which diviſion ſtill ſubſiſts, notwithſtanding the addition of a third ſecretary for Scotland. Ireland and the Plantations are under the direction of the elder ſecretary, who has the ſouthern province, which alſo comprehends France, Italy, Switzerland, Spain, Portugal, and Turky: the northern province includes the Low Countries, Germany, Denmark, Sweden, Poland, and Muſcovy. Each of the ſecretaries have an apartment in all the royal houſes, both for their own accommodation and their officers; they have alſo a table at the king's charge, or elſe board-wages. The two ſecretaries for South Britain, have each two under ſecretaries, and one chief clerk; and the ſecretary for North Britain has an under ſecretary, and one chief clerk, with an uncertain number of other clerks and tranſlators, all wholly depending on them. To the ſecretaries of ſtate belong the cuſtody of that ſeal properly called the ſignet, and the direction of two other offices, one called the paper-office, and the other the ſignet-office.

2. Secretary of an embaſſy, a perſon attending an embaſſador for writing diſpatches relating to the negotiation. There is a great difference between the ſecretary of an embaſſy, and the embaſſador's ſecretary; the laſt being a domeſtic or menial of the embaſſador, and the firſt, a ſervant or miniſter of the prince.

3. The ſecretary of war, an officer of the war-office, who has two chief clerks under him, the laſt of which is the ſecretary's meſſenger. There are alſo ſecretaries in moſt of the other offices.

SECRETION, *ſecretio*, the act whereby the ſeveral juices or humours of the animal body are ſeparated from the blood by means of the glands.

It is a thing well known to philoſophers, and particularly to chemiſts, that a piece of waſte paper, which conſiſts of a parcel of filaments connected together, being once ſoaked in oil or water, will not ſuffer any other liquor to paſs through it, but ſuch as it was ſaturated with before, ſtopping all others. It is alſo known that ſcraps of cloth or cotton imbued with oil or water,

and

S E C

PLATE CXIII.

Facing Sector.

Fig. 1.

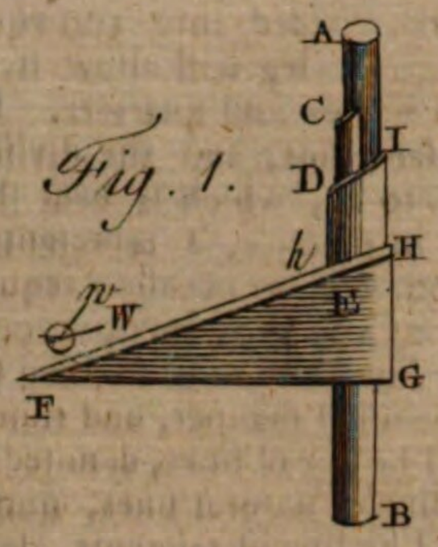


Fig. 2.

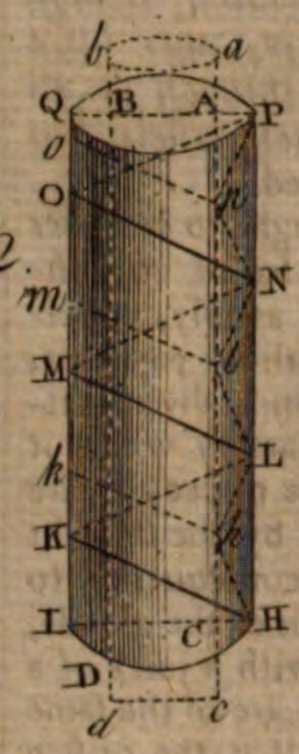


Fig. 3.

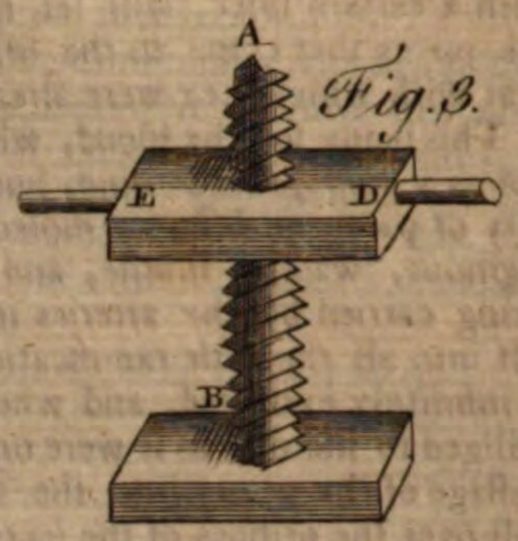


Fig. 4.

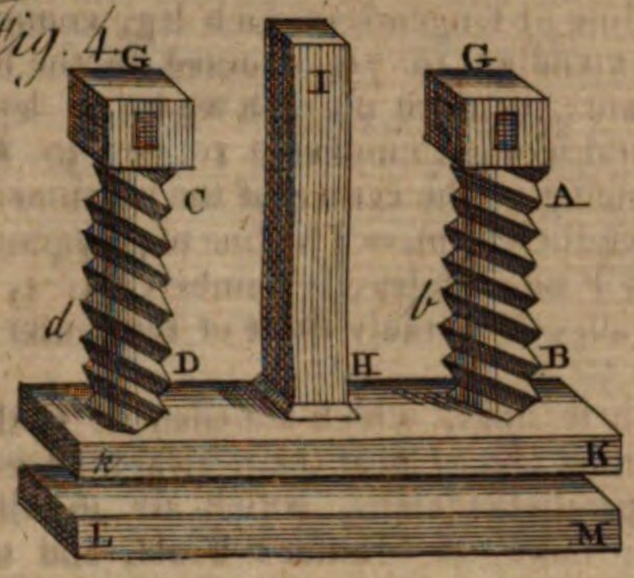


Fig. 5.

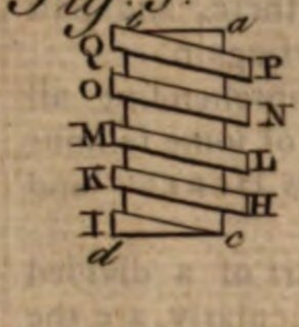
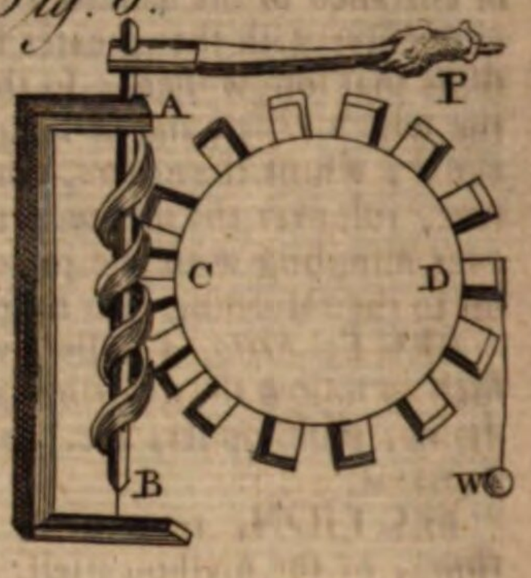


Fig. 6.



Archimedes's Screw.

Fig. 7.

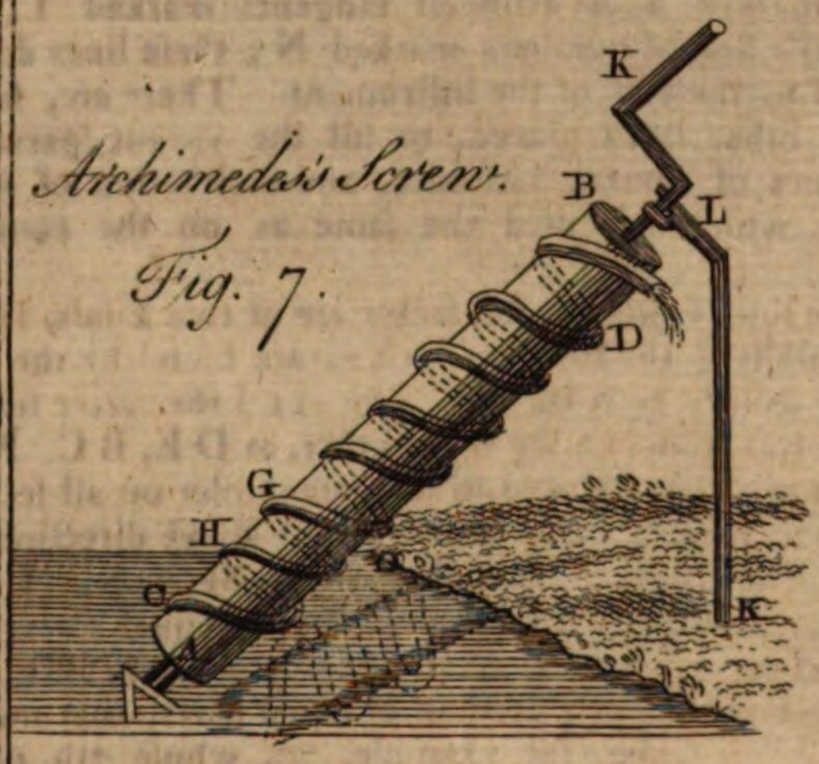


Fig. 8.

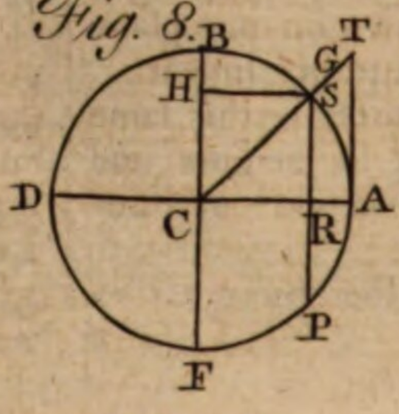


Fig. 9. 10.

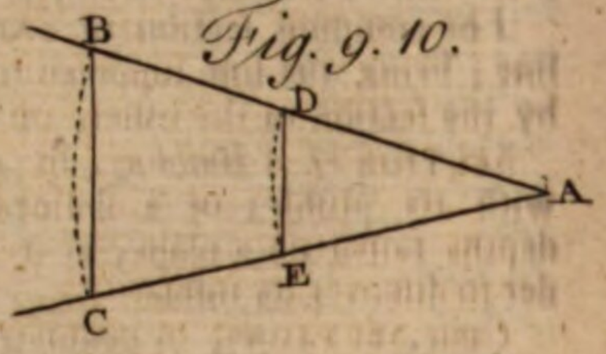


Fig. 11.

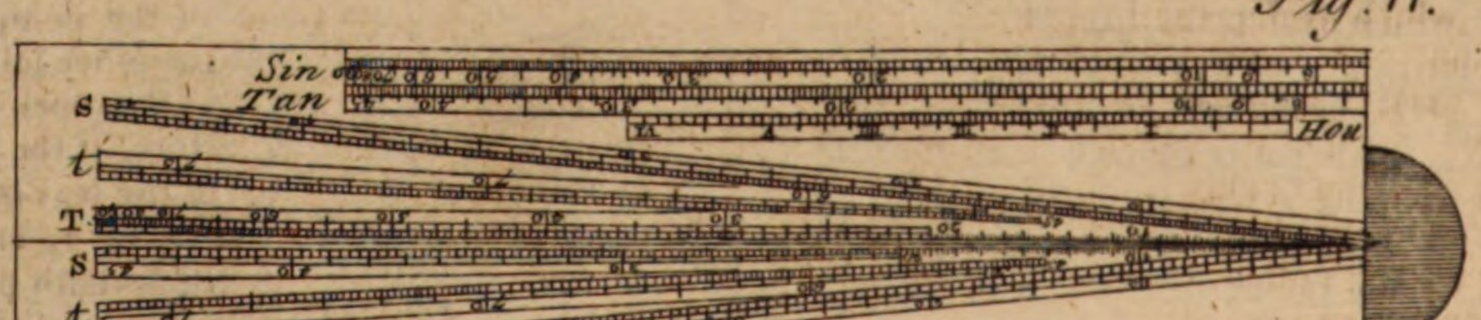


Fig. 12.

and dipped in a veſſel, in which oil and water are mixed together, that which was ſaturated with water will ſuffer nothing to paſs but water, and that which had the oil will let nothing paſs but oil.

There are to be found in the ſecretory veſſels of the glands a ſimilar ſtructure, an interwoven maſs of filaments very like thoſe of paper, cloth, or cotton, though diſpoſed a little differently. This texture, once filled with a certain juice, will let none paſs through of all the juices that come to the orifices of theſe veſſels, but that with which they were already ſaturated.

This being ſo, the blood, which we ought to conſider not as a homogeneous fluid, but as compoſed of an infinity of parts, or different molecules, ſuch as oily, mucilaginous, watery, ſubtile, and groſſer ſaline particles, being carried by the arteries into the gland, divides itſelf into all the little ramifications of the artery where it is infinitely extended, and wherein all the molecules are obliged to file off, as it were one by one, by the ſtraight paſſage of the artery into the vein, and conſequently to roll over the orifices of the ſecretory veſſels of the glands, whoſe villous texture is before ſaturated with a juice of a certain nature; and theſe particles, which are of the ſame nature with that juice which preſents itſelf at the orifice or entrance of the ſecretory veſſels, join themſelves to it, and enter with the greater liberty, being puſhed on by thoſe that follow them; ſo that they ſucceſſively run thro' the whole veſſel, and at length paſs out by the excretory canal; whilſt the others, which are not of the ſame nature, roll over the orifice of the ſecretory veſſels, without ever mingling with the juice they meet there, and paſs on to the returning vein to go to the heart again.

SECT, *Secta*, a collective term, comprehending all ſuch as follow the doctrines and opinions of ſome famous divine, philoſopher, &c. See the articles HERESY and SCHISM.

SECTION, in general, denotes a part of a divided thing, or the diviſion itſelf. Such, particularly, are the ſubdiviſions of a chapter; called alſo paragraphs and articles: the mark of a ſection is §.

SECTION, in geometry, denotes a ſide or ſurface appearing of a body or figure cut by another; or the place where lines, planes, &c. cut each other.

The common ſection of two planes is always a right line; being the line ſuppoſed to be drawn on one plane by the ſection of the other, or by its entrance into it.

SECTION *of a Building*, in architecture, is the ſame with its profile; or a delineation of its heights and depths raiſed on a plane, as if the fabric was cut aſunder to diſcover its inſide.

Conic SECTIONS, in geometry. See the articles CONE and CONIC.

SECTOR, a mathematical inſtrument, of great uſe in finding the proportion between quantities of the ſame kind, as between lines and lines, ſurfaces and ſurfaces, &c. for which reaſon the French call it the compaſs of proportion.

The great advantage of the ſector above common ſcales, &c. is, that it is adapted to all radii, and all ſcales. For, by the line of chords, ſines, tangents, &c. on the ſector, we have lines of chords, ſines, tangents, &c. adapted to any radius betwixt the length and breadth of the ſector, when opened.

The ſector is founded on the fourth propoſition of the ſixth book of Euclid, where it is demonſtrated, that ſimilar triangles have their homologous ſides proportional. An idea of its foundation or theory may be conceived from what follows: Let the lines A B, A C (plate CXIII. *fig.* 9.) repreſent the two legs of the ſector, and A D, A E, two equal ſections from the center. If now the points B C and D E be connected, the lines B C and D E will be parallel; therefore the triangles A D E, and A B C, will be ſimilar, and conſequently the ſides A D, D E, A B, B C, proportional; that is, as A D: D E::A B: B C; whence, if A D be the half, third, or fourth part of A B, D E will be a half, third, or fourth part of B C. Whence it follows, that, if B C be the chord, ſine, tangent, &c. of any number of degrees to the radius A B, D E will be the ſame to the radius A D.

Deſcription of the SECTOR.—This inſtrument conſiſts of two equal legs, or rules of braſs, &c. riveted together, but ſo as to move eaſily on the rivet; (*ſee fig.* 10.) on the faces of the inſtrument are placed ſeveral lines; the principal of which are the line of equal parts, line of chords, line of ſines, line of tangents, line of ſecants, and line of polygons.

The line of equal parts, called alſo the line of lines, marked L, is a line divided into 100 equal parts, and, where the length of the leg will allow it, each of theſe is ſubdivided into halves and quarters. It is found on each leg, on the ſame ſide, and the diviſions numbered 1, 2, 3, 4, 5, &c. to 10, which is near the extremity of each leg. Note, in practice, 1 repreſents either 1, 10, 100, 1000, 10000, &c. as occaſion requires, in which caſe, 2 repreſents 2, 20, 200, 2000, 20000, &c. and ſo of the reſt.—The line of chords, marked C on each leg, is divided after the uſual manner, and numbered 10, 20, 30, &c. to 60.—The line of ſines, denoted on each leg by the letter S, is a line of natural ſines, numbered 10, 20, 30, &c. to 90.—The line of tangents, denoted on each leg by the letter T, is a line of natural tangents, numbered 10, 20, 30, &c. to 45. Beſides which there is another little line of tangents on each leg, commencing at 45°, and extending to 75, denoted by the letter *t*.—Line of ſecants, denoted on each leg by the letter *ſ*, is a line of natural ſecants, numbered 10, 20, 30, &c. to 75, not commencing at the center of the inſtrument, but at ſome diſtance therefrom.—The line of polygons, denoted by the letter P on each leg, is numbered 4, 5, 6, &c. to 12, which falls conſiderably ſhort of the center of the inſtrument.

Beſides theſe lines, which are eſſential to the ſector, there are others placed near the outward edges on both ſides, and parallel thereto, which are in all reſpects the ſame as thoſe on Gunter's Scale, and uſed after the ſame manner. Such are the lines of artificial ſines marked S, of artificial tangents marked T, and Gunter's line of numbers marked N; theſe lines do not extend to the end of the inſtrument. There are, ſometimes, other lines placed, to fill the vacant ſpaces, as the lines of hours, latitudes, and inclination of meridians, which are uſed the ſame as on the common ſcales.

The lines found by the ſector are of two kinds, lateral and parallel; the firſt are ſuch as are found by the ſides of the ſector, as A B, A C (*fig.* 11.) the latter ſuch as go a-croſs from one leg to the other, as D E, B C. Note, the lines are not placed in the ſame order on all ſectors, but they may be eaſily found by the above directions.

Uſe of the Line of equal Parts on the SECTOR.—1. To divide a given line into any number of equal parts, ſuppoſe ſeven. Take the given line in your compaſſes, and, ſetting one foot in a diviſion of equal parts, that may be divided by ſeven, for example, 70, whoſe 7th part is 10, open the ſector till the other point fall exactly on 70, in the ſame line on the other leg. In this diſpoſition, applying one point of the compaſſes to 10, in the ſame line, ſhut them till the other fall in 10, in the ſame line, on the other leg, and this opening will be the 7th part of the given line. Note, if the line to be divided be too long to be applied to the legs of the ſector, divide only one half, or one fourth by 7, and the double or quadruple thereof will be the ſeventh part of the whole.

2. To meaſure the lines of the perimeter of a polygon, one of which contains a given number of equal parts. Take the given line in your compaſſes, and ſet it parallel upon the line of equal parts, to the number on each leg expreſſing its length. The ſector remaining thus, ſet off the length of each of the other lines parallel to the former, and the numbers each of them falls on, will expreſs their lengths.

3. A right-line being given, and the number of parts it contains, ſuppoſe 120, to cut from it any number of the ſame parts, ſuppoſe 25. Take the given line in your compaſſes, open the ſector till the two feet fall on 120 on each leg; then will the diſtance between 25 on one leg, and the ſame number on the other, give the parts required.

4. To multiply by the line of equal parts on the ſector.—Take the lateral diſtance from the center of the line to the given multiplicator; open the ſector till you fit that lateral diſtance to the paralliel of 1 and 1, or 10 and 10, and keep the ſector in that diſpoſition; then take in

the compaſſes the parallel diſtance of the multiplicand, which diſtance, meaſured laterally on the ſame line, will give the product required.—Thus, ſuppoſe it were required to find the product of 8, multiplied by 4: Take the lateral diſtance from the center of the line to 4 in your compaſſes, i. e. place one foot of the compaſſes in the beginning of the diviſions, and extend the other along the line to 4. Open the ſector till you fit this lateral diſtance to the parallel of 1 and 1, or 10 and 10. Then take the parallel diſtance of 8, the multiplicand; i. e. extend the compaſſes from 8, in this line, on one leg to 8 in the ſame line on the other, and that extent, meaſured laterally, will give the product required.

5. To divide by the line of equal parts on the ſector.—Extend the compaſſes laterally from the beginning of the line to 1, and open the ſector till you fit that extent to the parallel of the diviſor; then take the parallel diſtance of the dividend, which extent, meaſured in a lateral direction, will give the quotient required. Thus ſuppoſe it was required to divide 36 by 4; extend the compaſſes, laterally, the beginning of the line to 1, and fit to that extent the parallel of 4, the diviſor; then extend the compaſſes parallel, from 36 on one leg, to 36 on the other, and that extent, meaſured laterally, will give 9, the quotient required.

6. To work any proportion by the ſector.—Take the ſecond term lateral, and, opening the ſector, apply that extent parallel in the firſt term, and ſtay the ſector in that poſition; then take the parallel diſtance of the third term, which extent, meaſured laterally, gives the fourth term required. This is ſo eaſy, from what has already been ſaid, that it needs no example.

1. The uſe of the line of chords on the ſector.—1. To open the ſector ſo as the two lines of chords may make an angle or number of degrees, ſuppoſe 40. Take the diſtance from the joint to 40, the number of the degrees propoſed, on the line of chords; open the ſector till the diſtance from 60 to 60, on each leg, be equal to the given diſtance of 40; then will the two lines on the ſector form an angle of 40 degrees, as was required.

2. The ſector being opened, to find the degrees of its aperture. Take the extent from 60 to 60, and lay it off on the line of chords from the center; the number whereon it terminates will ſhew the degrees, &c. required.

3. To lay off any number of degrees upon the circumference of a circle. Open the ſector till the diſtance between 60 and 60 be equal to the radius of the given circle; then take the parallel extent of the chord of the number of degrees, on each leg of the ſector, and lay it off on the circumference of the given circle. Hence any regular polygon may be eaſily inſcribed in a given circle.

Uſe of the Line of Polygons on the SECTOR.—1°. To inſcribe a regular polygon in a given circle. Take the ſemi-diameter of the given circle, in the compaſſes, and adjuſt it to the number 6, on the line of polygons, on each leg of the ſector: then, the ſector remaining thus opened, take the diſtance of the two equal numbers, expreſſing the number of ſides the polygon is to have; e. gr. the diſtance from 5 to 5 for a pentagon, from 7 to 7 for a heptagon, &c. Theſe diſtances carried about the circumference of the circle will divide it into ſo many equal parts.

2°. To deſcribe a regular polygon, e. gr. a pentagon, on a given right line. Take the length of the line in the compaſſes, and apply it to the extent of the number 5, 5, on the lines of polygons. The ſector thus opened, upon the ſame lines take the extent, from 6 to 6; this will be the ſemi-diameter of the circle the polygon is to be inſcribed in. If, then, with this diſtance, from the ends of the given line, you deſcribe two arches of a circle, their interſection will be the center of the circle.

3°. On a right line, to deſcribe an iſoſceles triangle, having the angles at the baſe double that at the vertex. Open the ſector, till the ends of the given line fall on 10 and 10 on each leg; then take the diſtance from 6 to 6. This will be the length of the two equal ſides of the triangle.

Uſe of the Lines of Sines, Tangents, and Secants, on the SECTOR.—By the ſeveral lines diſpoſed on the ſector, we have ſcales to ſeveral radius's; ſo that having a length, or radius, given, not exceeding the length of the ſector when opened, we find the chord, ſine, &c. thereto. Ex. gr. Suppoſe the chord, ſine, or tangent, of 10 degrees, to a radius of 3 inches, required: make 3 inches the aperture, between 60 and 60, on the lines of chords of the two legs; then will the ſame extent reach from 45 to 45 on the line of tangents, and from 90 to 90 on the line of the ſines on the other ſide; ſo that to whatever radius the line of chords is ſet, to the ſame are all the others ſet. In this diſpoſition, therefore, if the aperture between 10 and 10, on the lines of chords, be taken with the compaſſes, it will give the chord of 10 degrees. If the aperture of 10 and 10 be in like manner taken on the lines of ſines, it will be the ſine of 10 degrees. Laſtly, if the aperture of 10 and 10 be in like manner taken on the lines of tangents, it gives the tangent of 10 degrees.

If the chord, or tangent, of 70 degrees were required; for the chord, the aperture of half the arch, viz. 35, muſt be taken, as before: which diſtance, repeated twice, gives the chord of 70°. To find the tangent of 70° to the ſame radius, the ſmall line of tangents muſt be uſed, the other only reaching to 45: making, therefore, 3 inches the aperture between 45 and 45 on the ſmall line; the extent between 70 and 70 degrees, on the ſame, will be the tangent of 70° to 3 inches radius.

To find the ſecant of an arch, make the given radius the aperture between 0 and 0 on the line of ſecants: then will the aperture of 10 and 10, or 70 and 70, on the ſaid lines, give the tangent of 10°, or 70°.

If the converſe of any of theſe things were required; that is, if the radius be required, to which a given line is the ſine, tangent, or ſecant, it is but making the given line, if a chord, the aperture on the line of chords, between 10 and 10, and then the ſector will ſtand at the radius required; that is, the aperture between 60 and 60, on the ſaid line, is the radius. If the given line were a ſine, tangent, or ſecant, it is but making it the aperture of the given number of degrees; then will the diſtance of 90 and 90 on the ſines, of 45 and 45 on the tangents, of 0 and 0 on the ſecants, be the radius.

Uſe of the SECTOR *in Trigonometry*—1°. The baſe and perpendicular of a rectangled triangle being given, to find the hypothenuſe. Suppoſe the baſe A C (plate CXIII. *fig.* 12) 40 miles and the perpendicular A B 30; open the ſector till the two lines of lines make a right angle: then for the baſe take 40 parts on the line of lines on one leg; and for the perpendicular 30 on the ſame line on the other leg: then the extent from 40 on the one, to 30 on the other, taken in the compaſſes, will be the length of the hypothenuſe, which line will be found 50 miles.

2°. The perpendicular A B of a right-angled triangle A B C being given, 30, and the angle B C A, 37°, to find the hypothenuſe B C. Take the given ſide A B, and ſet it over, on each ſide, upon the ſine of the given angle A C B; then the parallel diſtance of radius, or of 90 and 90, will be the hypothenuſe B C; which will meaſure 50 on the line of ſines.

3°. The hypothenuſe and baſe being given, to find the perpendicular. Open the ſector, till the two lines of lines be at right angles; then lay off the given baſe on one of thoſe lines from the center. Take the hypothenuſe in your compaſſes, and, ſetting one foot in the point of the given baſe, let the other fall on the line of lines, on the other leg: the diſtance from the center to the point where the compaſſes fall, will be the length of the perpendicular.

4°. The hypothenuſe being given, and the angle A C B, to find the perpendicular. Make the given hypothenuſe a parallel radius, i. e. make it the extent from 90 to 90 on the lines of ſines; then will the parallel ſine of the angle A C B be the length of the ſide A B.

5°. The baſe and perpendicular A B given, to find the angle B C A. Lay off the baſe A C on both ſides the ſector, from the center, and note its extent: then take the given perpendicular, and to it open the ſector, in the terms of the baſe; the parallel radius will be the tangent of B C A.

6°. In any right-lined triangle, two ſides being given with the included angle, to find the third ſide. Suppoſe

the

the ſide A C (*fig.* 13.) 20, the ſide B C 30, and the included angle A C B 110°; open the ſector, till the two lines of lines make an angle equal to the given angle, viz. 110. Lay off the given ſides of the triangle from the center of the ſector, on each of the lines of lines; the extent between their extremes is the length of the ſide A B ſought.

7°. The angles C A B and A C B given, and the ſide C B, to find the baſe A B. Take the given ſide C B, and turn it into the parallel fine of its oppoſite angle C A B; and the parallel fine of the angle A C B will be the length of the baſe A B.

8°. The three angles of a triangle being given, to find the proportion of the ſides. Take the lateral fines of the ſeveral angles, and meaſure them in the line of lines; the numbers anſwering thereto give the proportion of the ſides.

9°. The three ſides being given, to find the angle A C B. Lay the ſides A C, C B, along the line of lines, from the center; and ſet over the ſide A B in their terms: ſo is the ſector opened, in theſe lines, to the quantity of the angle A C B.

10°. The hypothenuſe A C (*fig.* 14.) of a right-angled ſpherical triangle A B C given, e. gr. 43°, and the angle C A B 20°; to find the ſide C B. The rule is: As radius is to the fine of the given hypothenuſe 43°, ſo is the fine of the given angle 20° to the fine of the perpendicular C B. Take therefore 20° from the center, along the line of fines, in your compaſſes, and ſet the extent from 90 to 90, on the two legs; and the parallel fine of 43°, the given hypothenuſe, will, when meaſured from the center or the line of fines, give 13° 30′ the ſide required.

11°. The perpendicular B C, and the hypothenuſe A C being given, to find the baſe A B. —As the fine complement of the perpendicular B C is to radius, ſo is the fine complement of the hypothenuſe to the fine complement of the baſe.—Make therefore the radius a parallel fine of the given perpendicular, then the parallel fine of the hypothenuſe meaſured along the line of fines will give the complement of the baſe required.

SECULAR, ſomething that is temporal, in which ſenſe the word ſtands oppoſed to eccleſiaſtical: thus we ſay, ſecular power, ſecular juriſdiction, &c.

Secular is more peculiarly uſed for a perſon who lives at liberty in the world, not ſhut up in a monaſtery, nor bound by vows, or ſubjected to the particular rules of any religious community; in which ſenſe it ſtands oppoſed to regular. The Romiſh clergy is divided into ſecular and regular.

SECULAR GAMES, *Ludi Seculares*, in antiquity, ſolemn games held among the Romans once in an age. Theſe games laſted three days and as many nights, during which time ſacrifices were performed, theatrical ſhews exhibited, with combats, ſports, &c. in the circus. The occaſion of theſe games, according to Valerius Maximus, was to ſtop the progreſs of a plague. The firſt who had them celebrated at Rome was Valerius Publicola, the firſt conſul created after the expulſion of the kings. The ceremonies to be obſerved therein were found preſcribed in one of the books of the Sibyls. At the time of the celebration of the ſecular games, heralds were ſent throughout all the empire, to intimate that every one might come and ſee thoſe ſolemnities which he never yet had ſeen, nor was ever to ſee again. Authors are not agreed as to the number of years wherein theſe games returned, partly becauſe the quantity of an age or *ſeculum*, among the antients, is not known, and partly on other accounts; ſome will have it that they were held every hundred years, and that the *ſeculum* or age was our century.

SECULAR POEM, *Carmen Seculare*, a poem ſung or rehearſed at the ſecular games, of which kind we have a very fine piece among the works of Horace, being a Sapphic ode at the end of his Epodes.

SECULARIZATION, the act of converting a regular perſon, place, or benefice, into a ſecular one.

SECUNDINES, *Secundinæ*, in medicine, the ſeveral coats or membranes incloſing the fœtus in the womb. Theſe are the chorion, amnios, and allantois.

It very often happens that theſe are retained in the womb after child-birth, and great miſchiefs enſue from it. The aſſiſtance of a ſkilful hand is, in many caſes, neceſſary to the getting them out; and this is to be done with great care and ſpeed, before the uterus cloſes itſelf upon them, otherwiſe, they occaſion terrible hæmorrhages, faintings, and often inflammatory and putrid fevers.

The patient herſelf may greatly promote the expulſion of theſe, by any forcible emotion of the body, as by a forced cough, or by ſneezing; the midwife at the ſame time is gently to pull them by the navel-ſtring, but this muſt be done very cautiouſly, for fear of its breaking. If this fails, the cautious introducing the hand often ſets all right, or the uſe of gently pellent medicines may be called in; and to theſe may be added broths, with ſaffron in them, and by the uſe of common clyſters great good is often done: but, if after all this care there yet remain ſome fragments of them behind, there uſually ariſes a fever within twelve hours; and, in this caſe, the utmoſt care muſt be taken to prevent putrefaction, and expel the remains of them. To theſe purpoſes medicines prepared with myrrh, amber, ſaffron, and the cortex Eleutherii, are of the greateſt ſervice; and to theſe may be added occaſionally the colliquating and attemperating ſalts, ſuch as tartarum vitriolatum and nitre. *Junker's Conſp. Med.*

SECURIDACA, in botany, a genus of plants, the corolla whereof is papilionaceous; the vexillum is roundiſh and very large; the alæ are obtuſe, and the carina lunulated. The fruit is roundiſh, ending in a very large, oblong, obtuſe, perpendicular membrane, broadeſt above; the ſeed is ſingle, and is inveſted with the whole pericarpium.

This plant taken inwardly is good for the ſtomach, and is an ingredient in antidotes uſed in a peſſary with honey before coition, ſuppoſed to prevent conception.

SECURIDACA is alſo the name whereby ſome authors call the coronilla. See CORONILLA.

SECURITATE PACIS, in law, a writ lying for a perſon who is threatened with danger from another againſt him that threatens; it iſſues out of the court of chancery, and is directed to the ſheriff, &c.

SEDANTIA, SEDATIVE MEDICINES, in pharmacy, ſuch medicines as are poſſeſſed of a power not only of compoſing, checking, and allaying the exorbitant and irregular motions of the ſolids and fluids, but alſo of alleviating and reſolving the painful ſpaſmodic ſtrictures of the parts.

As the effect of theſe medicines are very extenſive, we may juſtly include in their number paregorics, which not only relax and gently ſooth the rigid fibres, but alſo obtund the acrimony of the juices; anodynes, which alleviate the violence of racking pains; antiſpaſmodics, which mitigate and remove the ſpaſmodic ſtrictures of the parts; antiepileptics, which check convulſive motions; hypnotics, which procure ſleep; and narcotics, which induce a conſiderable ſtupor of the ſenſes and torpor of all the motions of the body.

SE DEFENDENDO, in law, a plea uſed for him that is charged with the death of another, by alledging that he was under a neceſſity of doing what he did in his own defence; as that the other aſſaulted him in ſuch a manner, that if he had not done what he did, he muſt have been in hazard of his own life. But here the danger muſt appear ſo great, as to be inevitable.

SEDIMENT, the ſettlement or dregs of any thing, or that groſs heavy part of a fluid body which, upon reſting, ſinks to the bottom of the veſſel.

SEDER OLAM, a Hebrew term, literally ſignifying order of the world; being the titles of two chronicles in that language. They are both very ſhort, though the one more ſo than the other; whence one is called Seder Olam Rabba, the Great Seder Olam; and the other Seder Olam Zuta, the Leſſer Seder Olam.

The Great Seder Olam commences at the creation of the world, and comes down as low as the war of the pſeudo-Meſſiah Barchochabas, under Adrian, fifty-two years after the deſtruction of the temple of Jeruſalem, and, of conſequence, to the 122d year of Chriſt. It is almoſt all taken from the ſcripture, excepting the end. It is the work of R. Joſa, ſon of Hhelpeta of Trippora, who lived in the ſecond century, about the year one hundred

undred and thirty, and was maſter of the famous R. uda Hakkadoſch, the compiler of the Miſchna.

The Leſſer Seder Olam is an abridgment of the former, brought down as far as Mar Sutra, who lived four hundred and fifty years after the deſtruction of the temple of Jeruſalem, or five hundred and twenty years after Chriſt. F. Morin, continually bent upon diminiſhing the antiquity of the principal books of the Jews, endeavours to prove it to have been wrote about the year of Chriſt one thouſand one hundred and twenty-four, as indeed is expreſſed at the beginning: but R. Dav. Gantz has overthrown this opinion in his Tſemahh David, and ſhewn, that the date, in the beginning, is an interpolation.

The two chronologies were firſt printed at Mantua in 1514, quarto; again, at Baſil, by Frobenius, in 1580, octavo: at Venice in 1545, quarto: at Paris, with a Latin verſion of Genebrard, in twelves. They have been ſince reprinted at Amſterdam, in 1711.

SEDR, or SEDRE, the high prieſt of the ſect of Ali among the Perſians.

SEDUM, in botany, a genus of plants, the corolla whereof conſiſts of five acuminated, lanceolated, plane, patent petals; the fruit conſiſts of five erecto-patent, acuminated compreſſed capſules, emarginated towards the baſe, and opening longitudinally upwards and downwards; the ſeeds are numerous and ſmall.

This genus comprehends the ſedum, or houſe-leek, orpine, wall-pepper, and other ſpecies: all which agree in virtues with orpine. See ORPINE.

SEED, *Semen*, a matter prepared by nature, for the reproduction and conſervation of the ſpecies, both in animals and vegetables.

Seed, in the animal œconomy, is a white, liquid matter ſeparated from the blood in the teſticles, and reſerved for the purpoſe of generation. See the article GENERATION.

SEED, in botany, the product of a plant, whereby the ſpecies is propagated. The ſeed is frequently the fruit of the plant; ſometimes it is only a part incloſed in the fruit, &c.

Dr. Agricola tells us that there is incloſed in ſeeds a little germ or bud that compoſes the prime and moſt noble part of the whole; and which, according as ſome curious perſons have calculated, hardly makes the thouſandth part of the ſeed; but, on this ſmall part, the image and repreſentation of the whole tree is perfectly delineated and expreſſed; and this principal part being any way hurt, ſpoiled, or loſt, the ſeed, however large or otherwiſe perfect, will come to nothing, but will rot in the earth.

In Malpighi's Life, p. 67, a debate may be ſeen between him and ſignior Triumphetti, whether the whole plant be actually in the ſeed: the affirmative is maintained by Malpighi with cogent arguments.

And, as the perpetuity and ſafety of the ſpecies depend upon the ſafety of the ſeed and fruit in a great meaſure, nature hath taken peculiar care for the conſervation and ſafety thereof; as particularly in ſuch as dare to ſhew their heads all the year, how ſecurely is their flower, ſeed, or fruit, locked up all the winter, together with their leaves and branches, in their germs, and well-fenced and covered there with neat and cloſe tunics? And, for ſuch as dare not ſo expoſe themſelves, with what ſafety are they preſerved under the coverture of the earth, in their root, ſeed, or fruit, till invited out by the kindly warmth of the ſpring? And, when the whole vegetable race is thus called out, it is very curious to obſerve the methods of nature in guarding thoſe inſenſitive creatures againſt harms and inconveniencies, by making ſome, for inſtance, to lie down proſtrate, and others to cloſe themſelves up upon the touch of animals; and the moſt to ſhut up their flowers, their down, or other their like guard, upon the cloſe or cool of the evening, for fear of rain, or other matters that may be prejudicial to the tender ſeed.

And to theſe conſiderations, relating to the ſeed, we might add the various ways of nature in diſſipating and ſowing it, ſome being, for this end, winged with light down or wings to be conveyed about by the winds; others being laid in elaſtic ſpringy caſes, that, when they burſt and crack, dart their ſeed at convenient diſtances, performing thereby the part of a good huſbandman; others, by their agreeable taſte and ſmell, and ſalutary nature, inviting themſelves to be ſwallowed, and carried about by the birds, and thereby alſo fertilized by paſſing through their bodies; and others, not thus taken care of, do many of them, by their uſefulneſs in human life, invite the huſbandman and gardener carefully to ſow and nurſe them up. Dr. Agricola ſays, the ſeeds of fruits, when ſeparated from them, though not kept in the earth, will live freſh and healthy a great many years by means of its intrinſic ſpirit; but, when it grows very old, it is unfit for vegetation.

But, notwithſtanding what ſome gardeners ſay, that ſome ſeeds are the better for being two or three years old; yet, he is of opinion that ſeed of one year old is beſt: for then the ſpirit is freſh and lively; the juices, which are the principle of nutrition and growth, are ſtill ſuſceptible of motion in the places of their reſidence; and the whole ſtructure is in a good diſpoſition.

The vegetative principle will indeed remain longer in one ſeed than in another, and in the long and round ſeed longer than in the flat and ſmall ſeed; for that in the large and round ſeed, as well as in the oval, the juices circulate more freely by an interior motion, and have a greater circuit. And, beſides that the juices are in them in greater abundance than in thoſe that are ſmall and flat, they can neither evaporate or dry ſo ſoon.

But, in thoſe ſeeds that are very old, the juices are conſumed and dried, and the organs are otherwiſe modified; and ſo the moving vegetative principle can act no longer for the fecundity of plants for the production of ſeeds.

Change of SEED, a term uſed by the farmers to expreſs the common, and, as they ſuppoſe, neceſſary cuſtom, of changing among one another the ſeed of their lands, as wheat, and the like; it being a received opinion, that the ſeed produced on one land will grow better on another, than on that which produced it, though the ſame ſpecies of plant be ſown.

Seeds, in their natural climate, do not degenerate, unleſs culture has improved them; they then indeed are liable, upon omiſſion of that culture, to return to their natural ſtate again. Whatever benefit ariſes to the farmer from the changing the ſeed of the ſame ſpecies, is from cauſes which are themſelves the effects of different climates, ſuch as heat and moiſture, which may vary very much in the ſame neighbourhood. There is a mountain in the Mogul's country, which on the ſouth ſide produces Indian plants, and on the north ſide European ones, from different expoſures. Some land retaining water longer is colder, and ſome letting it paſs off quicker is warmer; as it may alſo be from the nature and figure of its parts, which retain more of the ſun's heat than others. Sandy and gravelly grounds are always warmer than others, if they have ſome hollow and ſpongy ſtratum underneath, that will let the water paſs off.

The benefit ariſing from the change of ſeed is owing to theſe changes, not to the change of food; and theſe cauſes ſhew their effects chiefly in the generation of the ſeed. Flax ſeed, brought from Holland, and ſown here, will produce as fine flax as it does there, but, in the next generation, it will degenerate, become coarſer; by this means it will continue to degenerate every year, till after two or three years it is no better than our own ſeed produces, and yet the land ſhall be as good for this coarſe ſort, as when it produced the fine; ſo alſo it is, when the ſeeds of our own wheat are changed between farmer and farmer. And thus ſilk-worms hatched and bred in France of eggs brought from Italy, will make as fine ſilk as the Italian; but the eggs of thoſe laid in France will produce worms that make no better ſilk than thoſe produced in France, though their food is all the while the ſame.

Common barley, once ſown in the burning ſands in Wiltſhire, will for many years after, if ſown on indifferent warm ground, be ripe ſooner than any other barley by two or three weeks; but, if ſown on cold grounds farther north, it will be as late as any other barley, after two or three years. The weeds, which perplex the farmers in every field, grow as ſtrong and troubleſome one

year

year as another, and that without any change of ſeed at all. Theſe ſeem therefore to have been the natural produce of our ſoil, and corn and other uſeful plants to have been brought from other places, and improved by culture; theſe will therefore no longer retain their perfection and value, than ſuch culture is continued to them.

Laurembergius has carried this notion of degeneracy and change from the ſoil, ſo far as to affirm that wheat will, in ſome places, degenerate into rye; and in other places, rye will be exalted into wheat by the ſoil: but thoſe who are acquainted with botany know, that a horſe might as ſoon be changed into a bull by feeding in an improper paſture, as one plant degenerate into another by fault of the ſoil. *Tull's Huſbandry.*

SEEDLINGS, among gardeners, denote ſuch roots of gillyflowers as ſpring from ſeed; alſo the young tender ſhoots of any plants that are newly ſowed.

SEEDY, in the brandy trade, a term uſed by the dealers to expreſs a fault that is found in ſeveral parcels of French brandy, which renders them unſaleable. The French ſuppoſe that theſe brandies obtain the flavour which they expreſs by this name, from the weeds which grow among the vines, from whence the wine, of which this brandy was made, was preſſed.

However it be, the thing is evident, and the taſte not of any one kind; but ſome pieces of brandy taſte ſtrongly of aniſeed, ſome of caraway-ſeed, and ſome of other of the ſtrong flavoured ſeeds of plants, principally of the umbelliferous kind; ſo that it ſhall be rather taken for aniſeed, caraway, or ſome other water, than for brandy.

The proprietor of ſuch brandies is always at great trouble to get them off, and uſually is reduced to the neceſſity of mixing them in ſmall quantities with pieces of other brandies, ſo as to drown and conceal the taſte; and, where he has not opportunities of doing this, is obliged to ſell them on very diſadvantageous terms.

The buſineſs of rectification of ſpirits is very little underſtood abroad, though very much practiſed with us; and a man in France or Holland, who could take off this taſte from theſe brandies, might get great advantages by it. There is no doubt but that the ſame means which we uſe to rectify malt ſpirits, that is, to clear it of its nauſeous and ſtinking oil, which always riſes with it in the firſt diſtillation, would alſo ſerve to purify theſe brandies, and, by leaving theſe extraneous oils behind, render them as well taſted as any others; ſince there is no queſtion, but that the oil of malt, which is a principle of the ſame ingredients with the ſpirit, is more firmly united to it than flavouring oils in the brandy, which are not the produce of the grape, but of ſome foreign matter only accidentally mixed with it.

It is a miſtake to imagine, that all the brandies made in France are ſo fine as thoſe which we meet with on the keys of London; on the contrary, there are many hundred pieces made every year, which are as badly flavoured as our coarſeſt malt ſpirit: but the caſe is this, they ſend the beſt brandies and the beſt wines to England, where they can get the beſt prices for them. In Holland, on the contrary, the mart of goods of all ſorts, it is ſometimes difficult to pick one piece of good brandy out of fifty, the general run of them being either ſeedy, muſty, oily, or otherwiſe infected with ſome unnatural and diſagreeable flavour; and theſe are the ſorts which in France they deſpair of curing by re-diſtillation, or bringing to the ſtate of three fifths, or trois cinques, as they expreſs their ſtronger brandies. *Shaw's Eſſay on Diſtillery.*

SEEING, the act of perceiving external objects by means of the eye, thence called the organ of ſight.

SEELING, a term uſed by dealers in horſes to denote a ſmall ſpot of white hairs growing among the natural ones on the eye-brow; and which is a certain mark of old age. A horſe is ſaid never to feel before he is fourteen, and always does ſo before he is ſixteen.

SEGMENT *of a Circle*, in geometry, a part of a circle, comprehended between an arch and the chord thereof.—Or it is a part of a circle leſs than a ſemicircle, comprehended between a right line, and a part of the circumference.

Thus the portion A E B A (plate CXIV. *fig.* 1.) comprehended between the arch A F B and the chord A B, is a ſegment of the circle A B E D.

As it is evident every ſegment of a circle muſt either be greater or leſs than a ſemi-circle, the greater part of the circle cut off by a chord, i. e. the part greater than a ſemi-circle, is called the greater ſegment, as A D E B; and the part leſs than a ſemi-circle, the leſſer ſegment, as A F B.

The angle which the chord A B makes with a tangent L B, is called the angle of a ſegment.

Line of SEGMENTS. See SECTOR.

SEGMOIDAL *Valves*, in anatomy, are ſmall valves ſituated in the pulmonary artery, reſembling ſegments of circles, whence they had their name.

SEIGNORAGE, a right or due belonging to a ſeigneur or lord.

It alſo implies a right or due belonging to a prince for the coining of money.

SEIGNORY, a manor or lordſhip.

SEISIN, in law, implies poſſeſſion; and is of two kinds; ſeiſin in law, and ſeiſin in fact. The former ſignifies ſomething done, which the law accounts a ſeiſin; as an enrollment, &c. And the latter an actual and corporal poſſeſſion taken.

SEISURE, in commerce, implies the arreſting ſome goods, merchandize, &c. either by expreſs order of the ſovereign, or in conſequence of ſome law.

SEIZING, among ſailors, the act of faſtening any two things together with a cord or line: alſo the cord or line which faſtens them.

SELANDERS, in farriery, the ſame with melanders. See MELANDERS.

SELENITÆ, moon-ſtone, in natural hiſtory, form a particular claſs of foſſils of a rhomboidal, pellucid form, diviſible into laminæ.

SELENOGRAPHY, that part of coſmography which relates to the moon. See the article MOON.

The word is formed from the Greek, σελήνη, the moon, and γράφω, to deſcribe.

SELEUCIDÆ, a race of Grecian kings who reigned as ſucceſſors of Alexander the Great in Syria.—Their eſtabliſhment is a celebrated æra in chronology, called the Syro-Macedonian æra, or that of the Seleucidæ; and which, according to the beſt authors, began 12 years after the death of Alexander the Great, and 311 before Chriſt.

SELF-*Opens*, a term uſed by the miners in the north of England to expreſs certain natural cavities or chambers, which are frequently met with, ſome near the ſurface, ſome at very great depths, ſome ſmall, and others very large.

Theſe are of various figures, and often run into ſtrange ſinuſes. Dr. Liſter, in accounting for the origin of earthquakes, ſuppoſes the whole cruſt of the earth to be more or leſs hollowed in this manner; which he alſo argues for, from the ſtreams of waters which ariſe in large quantities from the ſides of mountains, and muſt have communication with theſe ſelf-opens, and ſupplies from them.

The natural hollows the doctor thinks to be the means of continuing and propagating earthquakes; the firſt cauſe of which he aſcribes to the breath of the pyrites, which he alſo ſays is the pyrites itſelf *totâ ſubſtantiâ.* This he obſerves takes fire of itſelf, on being expoſed to the air in our ſight, and may do ſo, from various other cauſes, under-ground. The ſulphureous ſmell of the air and waters, before and after earthquakes, in the places where they happen, ſeems a proof that they owe their origin to ſome ſuch ſulphureous matter as this ſtone; and the rolling and deſultory noiſe of an earthquake, ſeems alſo to ſhew that it is not expanded any way at once, but is propagated through a chain of theſe ſubterranean hollows.

It is not neceſſary that we ſhould ſuppoſe a continued chain of them, from the place where the earthquake begins to be felt, to the ſpot where it ends; but, if there are many of them irregularly ſcattered about the earth, the force of the exploſion will be ſufficient to burſt thro' the ſolid parts between, and open a paſſage from one to the others, which may continue open no longer than

the force continues, and after the ſhock is over cloſe together again, ſo as to leave no trace where it was.

Our miners not only find the natural caverns, but they alſo find them often full of what they call fire damps, which are inflammable vapours, of the very nature of thoſe which occaſion earthquakes, and, when fired, make the ſame exploſions, and cauſe the ſame effects in a certain degree. Theſe ſometimes require a candle, or other actual fire, to come in contact, in order to kindle them; but ſometimes they are found kindled of themſelves, and flaming on the ſurface of the waters, in the bottoms of the pits, or at the fiſſures of the coal. *Philoſ. Tranſ.* N°. 157.

SELL, among builders, implies the loweſt piece of timber in a timber-building, being that on which the whole ſuperſtructure is raiſed. It is alſo applied by ſome to the bottom part of a window frame.

SELLA *Equina*, *Turcica*, or *Sphænoides*, in anatomy, imply the four apophyſes of the os ſphænoides in the brain. They have the name from their reſembling a ſaddle, which the Latins called *ſella*.

SELVAGE, among ſailors, a ſort of ſtrop or wreath formed to faſten on any particular rope, whereby to hook a tackle. See the article TACKLE.

SEMBRADOR, an inſtrument invented by Don Joſeph de Lucatello, for the more evenly ſowing of ſeeds, and in many particulars reſembles the drill-plough of Mr. Tull.

SEMEIOTICA, that part of medicine which treats of the ſigns of health and diſeaſes.

The word is formed from the Greek, σημειον, a ſign.

SEMEN, *Seed*. See the article SEED.

SEMETS, in botany, the ſame with antheræ. See ANTHERÆ.

SEMI, a word borrowed from the Latin, which ſignifies half. It is uſed only in compoſition with other words.

SEMI-ARIANS, a branch of the Arian heretics, ſo called, from their pretending to condemn the errors of Arius, though they in reality maintained his principles; the only difference conſiſting in their palliating and concealing them under ſofter and more moderate terms. They would not allow, with the Catholics, that the Son was ομοσιος, of the ſame ſubſtance, but only ομοιοσιος, of a like ſubſtance with the Father: and therefore, tho' they differed from the orthodox in a ſingle letter only, yet, in effect, they denied the divinity of Chriſt, and placed him in the rank of creatures.

SEMI-BREVE, in muſic, a note or meaſure of time, being equal to half a breve, three minims, four crotchets, &c.

SEMI-CIRCLE, in geometry, a figure comprehended between the diameter of a circle, and half the circumference.

SEMI-COLON, one of the ſtops uſed by grammarians to diſtinguiſh the different members of a ſentence. It is marked thus (;) and implies a ſhorter pauſe than a colon, whence it has its name. See the article PUNCTUATION.

SEMI-CUBICAL PARABOLA, a name given by mathematicians to a curve of the ſecond order, wherein the cubes of the ordinates are in proportion to the ſquares of the abſciſſes.

SEMI-CUPIUM, a half bath, in which the parts of the patient below the navel only are immerſed.

SEMI-DIAMETER, half the diameter, or radius, being a line drawn from the center of a circle or ſphere to its circumference. See the article RADIUS.

SEMI-DIAPENTE, in muſic, a falſe or defective fifth.

SEMI-DIAPASON, in muſic, a falſe or defective octave.

SEMI-DIATESSARON, in muſic, a defective or falſe fourth.

SEMI-FLOSCULOUS, in botany, implies the flowers of a claſs of flowers whoſe petals are hollow in the lower part, but in the upper flat, and continued in the ſhape of a tongue. The dandelion, hawkweed, &c. are of this kind.

SEMI-LUNAR VALVES, in anatomy, are three ſmall membranous valves of a ſemi-lunar figure placed in the orifice of the pulmonary artery, to prevent the blood's flowing into the heart at the time of its dilatation.

SEMI-MEMBRANOSUS, a long thin membranous muſcle, ſituated on the backſide of the thigh, and ariſes from the tubercle of the iſchium. It is one of the fluxors of the tibia.

SEMINAL, ſpermatic, or ſomething belonging to the ſeed.

SEMINARY, in popiſh countries, are certain colleges appointed for the inſtruction and education of young perſons deſtined for the ſacred miniſtry. The firſt inſtitution of ſuch places is aſcribed to St. Auguſtine. And the council of Trent decrees, that children exceeding twelve years of age ſhall be brought up, and inſtructed in common, to qualify them for the eccleſiaſtical function, and that there ſhall be a ſeminary of ſuch belonging to each cathedral, under the direction of the biſhop.

SEMINARY, in gardening, implies the ſeed-plot, or piece of ground allotted for raiſing plants from ſeed, and keeping them till they are fit to be removed into the garden or nurſery.

SEMINATION, in agriculture, the act of ſowing, or ſcattering the ſeed.

SEMI-NERVOSUS, half nervous, in anatomy, a muſcle ariſing from the protuberance of the iſchium, and inſerted, by a round tendon, into the internal part of the epiphyſis of the tibia, and helps to bend the leg.

SEMI-ORDINATE, half of an ordinate. See ORDINATE.

SEMI-PELAGIANS, chriſtian heretics, ſo called from their being a branch of the Pelagians. See PELAGIANS.

They pretended to keep a mean between the Pelagians and the orthodox, but in fact agreed with neither. They allowed original ſin, with the orthodox, but denied that the liberty of the will could be ſo impaired thereby, that men could not of themſelves do ſomething which might induce God to afford his grace to one more than another. They taught that the grace by which men are ſaved, is not given them by the mere will of God, but according to his eternal preſcience, by which he foreſaw who they were that would believe in him. As to election, they held that it depended on our perſeverance: God chuſing ſuch only to eternal life, as continued ſtedfaſt in the faith.

Caſſian, who had been a deacon of Conſtantinople, and was afterwards a prieſt of Marſeilles, was the chief of the Semi-pelagians. St. Proſper, in a letter to St. Auguſtine, calls them *Reliquias Pelagii*.

SEMI-QUAVER, in muſic, a note whoſe length is equal to half a quaver.

SEMIS, among the ancient Romans, was equal to half the as. See As.

SEMISPINALIS *Colli*, in anatomy, a name given to all that fleſhy maſs which lies between the tranſverſe and ſpinal apophyſis, from the ſecond vertebræ of the neck, to the middle of the back; the ſplenius and the complexus major, which cover it, having been raiſed.

It is compoſed of ſeveral oblique converging muſcles, which may be divided into external and internal; and of theſe the external are the longeſt.

The external are fixed below the tranſverſe apophyſis of the ſixth, ſeventh, eighth, or ninth upper vertebræ of the back, by tendinous extremities, which, as they aſcend, become fleſhy and mix with each other. Their ſuperior inſertions in the neck are ſix in number, of which the firſt, which is tendinous, is in the ſeventh ſpinal apophyſes; the reſt, which are fleſhy, are in the five next ſpinal apophyſes.

The loweſt of theſe external muſcles ariſe more or leſs, by ſome communicating fleſhy fibres with the ſpinalis longiſſimus and ſemi-ſpinalis dorſi.

The internal are ſhorter and more oblique than the external, and partly covered by them. They are fixed by their lower extremities to the tranſverſe apophyſis of the third or fourth upper vertebræ of the back, and to the oblique apophyſis of the fourth or fifth lower vertebræ of the neck, and by their other extremities they are inſerted in the ſixth ſpinal apophyſes of the neck. Some of theſe internal muſcles are very ſhort, lying wholly between

the ſpinal apophyſes and the oblique or tranſverſe apophyſes next them.

The ſemi-ſpinalis or tranſverſe ſpinales of both ſides, acting together, extend the neck upon the trunk, to keep it from inclining forward in ſtanding or ſitting, and bend it backward. The ſemi-ſpinales of one ſide, acting alone, produce the ſame motions in an oblique direction, and in that caſe are aſſiſted by the inferior or vertebral portion of the neighbouring ſplenius under which they croſs.

The ſemi-ſpinales of both ſides may alſo ſerve for the rotation of the neck, but then the inferior ſplenius of the oppoſite ſide muſt aſſiſt them. This motion is made in the ordinary ſituation of the neck, principally on the fourth and fifth vertebræ. They may alſo perform the lateral inflections of the neck, by aſſiſting the longus colli and anterior vertebral muſcles of the ſame ſide.

SEMI-SPINALIS *Dorſi*, in anatomy, a fleſhy maſs, which, from all the ſpinal and tranſverſe apophyſes of the back and loins, is extended in diſtinct faſciculi over the vertebræ themſelves. It is made up like that of the neck of ſeveral oblique, converging, vertebral muſcles, the uppermoſt of which is fixed below to the third tranſverſe apophyſis of the loins, and above to the laſt ſpinal apophyſis of the back.

They may be divided into external, which are firſt diſcovered, and internal, which lie immediately on the vertebræ. The external, from the firſt vertebræ to the ſeventh incluſively, appear to be longer than the internal, which are covered by them. They may alſo be diſtinguiſhed into thoſe which go from one tranſverſe to ſeveral apophyſes, and thoſe which go from ſeveral tranſverſe to one ſpinal apophyſis.

The ſemi-ſpinales, or tranſverſe ſpinales, being obliſque, converging, vertebral muſcles, are aſſiſtants to the ſacro-lumbaris and longiſſimus dorſi, which they croſs on each ſide. By this decuſſation, joined to the multiplicity and graduated diſtribution of their inſertions, they increaſe the ſtrength of the other muſcles conſiderably, whether they act equally and uniformly with them, or alternately. The lumbar ſemi-ſpinales, called by the ancients muſculus ſacer, becauſe of their inſertions in the os ſacrum, are more expoſed to motions and ſtrains, than thoſe of the back, and are alſo larger and thicker. They are much better fitted than the ſacro-lumbares for ſupporting the pelvis on both ſides in walking, and on one ſide when we raiſe the foot on that ſide, and ſupport ourſelves on the other. *Winſlow's Anat.*

SEMITA LUMINOSA, a name given by aſtronomers to a lucid tract in the heavens, viſible about ſix o'clock at night, a little before the vernal equinox. It extends from the weſtern edge of the horizon up towards the Pleiades.

Caſſini was of opinion that this lucid tract was owing to a vaſt number of planets encompaſſing the ſun, whoſe light they reflected.

SEMPERVIVUM, houſeleek, the name of a well-known plant, which is uſed in medicine as a cooler.

SENA, the leaf of an annual, woody, pod-bearing plant, brought dry from Alexandria in Egypt. It is of a lively yellowiſh green colour, an oblong ſomewhat oval figure, ſharp-pointed at the ends, about a quarter of an inch broad, and not a full inch in length. Some inferior ſorts are brought from Tripoli and other places: theſe may be diſtinguiſhed, by their being either narrower, longer, and ſharper-pointed; or larger, broader, and round-pointed, with ſmall prominent veins; or large, obtuſe, and of a freſh green colour, without any yellow caſt.

Sena is a moderately ſtrong, and in general a ſafe cathartic: Geoffroy ſpecifies hemorrhages, inflammations of all kinds, and diſorders of the breaſt, as being almoſt the only exceptions to its uſe. The doſe in ſubſtance is from a ſcruple to a dram; in infuſion, from one dram to three or four. It gives out its virtue both to watery and ſpirituous menſtrua: to water and proof ſpirit it communicates a browniſh colour, more or leſs deep according to the proportions; to rectified ſpirit, a fine green. There are two inconveniencies often complained of in this medicine; its being liable, in ſome conſtitutions, to occaſion gripes; and its being accompanied with an ill flavour, which is apt to nauſeate both the ſtomach and the palate. The firſt may be obviated by dilution, the latter by aromatic and other additions: ſeveral compoſitions of this kind are prepared in the ſhops, both ſufficiently palatable, and which operate with eaſe and mildneſs.

Six drams of tamarinds and two of cryſtals of tartar are boiled in a pint and a half of water, till half a pint is waſted, and the ſtrained liquor poured boiling hot upon one, two, or three drams of ſena: after maceration for four hours, the ſtrained infuſion is ſweetened with an ounce of ſyrup of violets, and flavoured with half an ounce of ſimple cinnamon water. Three drams of ſena are infuſed in a quarter of a pint of boiling water, for four hours, or till the liquor has grown cold; with the addition of a ſcruple of ginger; or with half a dram of leſſer cardamom ſeeds huſked, and three fourths of a dram of cryſtals of tartar, which laſt are previouſly boiled in the water till diſſolved; or with two drams of freſh lemon peel, and two drams by meaſure of lemon juice. The committee of the London college obſerve, that this laſt is the moſt agreeable form they have been able to contrive, for the exhibition of ſena to thoſe who are more than ordinarily offended with its flavour; and that though acids are generally ſuppoſed to impede the action of water on vegetables, yet the infuſions of ſena made with acids are found, from experience, not to fail in their intention. Indeed, if the acids really weaken the diſſolving power of the water, which it is probable they do in ſome degree, they ſhould ſeem to be, on this account, rather of advantage than otherwiſe; for, as the committee further obſerve, in a medicine very nauſeous to many, it is of primary conſequence that only the lighter and leaſt diſguſtful parts be extracted. On this principle, ſome macerate the ſena for a night in cold water, which becomes ſufficiently impregnated with its purgative virtue, without extracting ſo much, as boiling water does, of the nauſeous matter: if the liquor, poured off from the ſena, be boiled a little by itſelf, great part of its ill flavour will be diſſipated; and the remains of its offenſiveneſs may be effectually covered by infuſing in it ſome Bohea tea. If the coction is continued for any conſiderable time, the purgative virtue of the ſena will be diminiſhed; for the inſpiſſated watery extracts are ſcarcely found to purge ſo much, as one fourth of the infuſion or decoction they were made from, or ſo much as an equal weight of the leaves in ſubſtance.

The officinal ſpirituous tinctures of ſena are prepared by digeſtion for ſome days with or without heat, in proof ſpirit. The proportions, in the London Pharmacopœia, are, one dram of ſena to an ounce and a quarter of the ſpirit, to which are added a dram and a quarter of ſtoned raiſins, ſeven grains and a half of caraway ſeeds, and two grains and a half of leſſer cardamom ſeeds huſked: in the Edinburgh, half a dram of ſena to an ounce and a half of the ſpirit, with the addition of fifteen grains of rhubarb, ſeven grains and a half of ſhavings of guaiacum, the ſame quantity of ſweet fennel ſeeds, the ſame of juniper berries, and forty-five grains of white ſugar-candy in powder, which laſt is directed to be diſſolved in the tincture, after ſtraining it from the other ingredients. Both theſe tinctures are agreeable and uſeful carminative purgatives, eſpecially to thoſe who have accuſtomed themſelves to ſpirituous liquors; the ill flavour of the ſena is completely covered, and its offending the ſtomach or producing gripes prevented, by the warm ſeeds and the ſweets. The guaiacum, in the ſecond preſcription, promotes the operation of the ſena; for two drams of ſena, infuſed in half a pint of a decoction of guaiacum, purge as briſkly as three drams infuſed in plain water, and with greater eaſe to the patient. Several compoſitions of this kind have been offered to the public, under the name of Daffy's Elixir: the two above are inferior to none, and ſuperior to moſt of them.

SENATE, an aſſembly, or council of ſenators; that is, of the principal members of a ſtate, who have a ſhare in the government.

SENATOR, a member of a ſenate.

SENATUS-CONSULTUM, a vote or reſolution of the Roman ſenate, with regard to ſome queſtion or liti-

gated

gated point, and which reſolution then became a part of the Roman law.

SENDING, in the ſea language, the act of pitching or plunging headlong with the ſhip's fore part. See PITCHING,

SENGREEN, in botany, the ſame with Sempervivum. See the article SEMPERVIVUM.

SENNA. See SENA.

SENNAT, among ſailors, a ſort of braided cordage formed by the platting of five, ſeven, or nine rope yarns into one another; it is employed for various uſes in a ſhip, particularly to form netting, &c. See the article NETTING.

SENSATION, the act of perceiving external objects, by means of the organs of ſenſe.

To conceive the manner wherein ſenſation is affected, obſerve, that all the organs conſiſt of little filaments, or nerves, which have their origin in the middle of the brain, are diffuſed thence throughout all the members which have any ſenſe, and terminate in the exterior parts of the body; that when we are in health, and awake, one end of theſe nerves cannot be agitated or ſhaken, without ſhaking the other, by reaſon they are always a little ſtretched; as in the caſe of an extended chord, one part of which cannot be ſtirred without a like motion of all the reſt.

It is to be likewiſe obſerved, that theſe nerves may be agitated two ways, either at the end out of the brain, or that in the brain. If they be agitated from without, by the action of objects, and their agitation be not communicated as far as the brain; as frequently happens in ſleep, when the nerves are in a ſtate of relaxation; the ſoul does not then receive any new ſenſation. But if the nerves happen to be agitated in the brain, by the flux of the animal ſpirits, or any other cauſe; the ſoul perceives ſomething, though the parts of thoſe nerves, that are out of the brain, diffuſed through the ſeveral parts of the body, remain at perfect reſt: as likewiſe is frequently the caſe in ſleep.

Laſtly, obſerve, that experience tells us, we may ſometimes feel pain in parts of the body that have been entirely cut off, by reaſon of the fibres in the brain correſponding to them being agitated in the ſame manner as if they were really hurt; the ſoul feels a real pain in thoſe imaginary parts.

All theſe things ſeem to ſhew, that the ſoul reſides immediately in that part of the brain wherein the nerves of all the organs of ſenſe terminate: we mean, it is there it perceives all the changes that happen with regard to the objects that cauſe them, or that have been uſed to cauſe them; and that it only perceives what paſſes out of this part, by the mediation of the fibres terminating in it.

Theſe things premiſed, it will not be difficult to explain how ſenſation is performed: the manner of which may be conceived from what follows. When the point of a needle, for inſtance, is thruſt againſt the hand, that point ſtirs and ſeparates the fibres of the fleſh, which fibres are extended from that place to the brain, and when we are awake, are in ſuch a degree of tenſion, as that they cannot be ſtirred without ſhaking thoſe of the brain. If then the motion of the fibres of the hand be gentle, that of the fibres of the brain will be ſo too; and, if the firſt be violent enough to break any thing in the hand, the laſt will be ſtronger and more violent in proportion. In like manner, if the hand be held to the fire, the little particles of the wood it throws off in great numbers, and with a great deal of violence, ſtriking againſt theſe fibres, and communicating a part of their agitation thereto; if the action be moderate, that of the extremities of the fibres of the brain, correſponding to thoſe of the hand, will be moderate likewiſe: if it be violent enough to ſeparate any of the parts of the hand, as it happens in burning; the motion of the fibres in the brain will be proportionably more violent. This is what befals the body, when objects ſtrike upon it. We are now to conſider how the mind is affected.

The mind, we have obſerved, reſides principally, if we may be allowed to ſay ſo, in that part of the brain where all the fibres of the nerves terminate. It attends here, as its ſenſory, or office, to look to the preſervation of all the parts of the body; and, of conſequence, muſt be here advertiſed of all the changes that happen, and muſt be able to diſtinguiſh between thoſe agreeable to the conſtitution of the body, and thoſe hurtful thereto. Any other abſolute knowledge, without a relation to the body, were uſeleſs. Thus, though all the changes in our fibres do, in reality, conſiſt in motions, which ordinarily only differ as to more and leſs; it is neceſſary the ſoul ſhould conſider them as changes eſſentially different; for, though in themſelves they differ but very little, yet, with regard to preſervation of the body, they are to be looked on as eſſentially different.

The motion, for inſtance, which cauſes pain, frequently differs exceeding little from that which occaſions a pleaſing titillation: it is not neceſſary there ſhould be an eſſential difference between theſe two motions; but it is neceſſary there be an eſſential difference between the pain and the tickling, which thoſe two motions occaſion in the ſoul; for the agitation of the fibres, which accompanies the titillation, informs the ſoul of the good ſtate of the body, that it is able to reſiſt the impreſſion of the objects, and that it need not apprehend its being hurt: but the motion which occaſions pain, being ſomewhat more violent, is capable of breaking ſome of the fibres of the body; wherefore it is neceſſary the ſoul be advertiſed hereof by ſome diſagreeable ſenſation, that it may provide againſt it.

Thus, though all the motions which paſs in the body only differ in themſelves, as to more or leſs, yet, when conſidered with regard to the preſervation of life, they may be ſaid to be eſſentially different: for this reaſon it is, that the ſoul does not perceive the ſhakes, or motions themſelves, which objects excite in the fibres of the fleſh: it would be uſeleſs to perceive them; and ſhe would never be able, thence, to learn whether the objects were capable of doing hurt or good. But ſhe perceives herſelf affected with ſenſations, which differ eſſentially, and which ſhewing preciſely the qualities of the objects, as they regard the body, make her perceive diſtinctly, whether or no thoſe objects are capable of hurting it.

In effect, from a ſtrict examination of the ſeveral ſenſes, it appears, that ſenſible objects act no otherwiſe upon the body, for the producing of ſenſation, than by exciting a change in the extreme ſurface of the fibres of the nerves: the quality of which change depends on the figure, bulk, hardneſs, and motion of the object; ſo that, according to all appearance, the moſt different objects, which ſhould agree in theſe four circumſtances, would produce the ſame ſenſation.

From the various texture of the object, the diverſity of the nerve affected, the different fabric of the organ of ſenſe, the different place in the medulla of the brain where the nerve ariſes, and the different degree of motion wherewith the action of the object is applied, cauſe various ſenſations and ideas in the mind; none of which repreſent any thing in the action of the object, or in the paſſion of the organ. And yet the ſame action of the ſame object on the ſame organ, always produces the ſame ſenſation or idea: and the ſame ideas neceſſarily follow the ſame diſpoſition of the ſame ſenſible organ, in the ſame manner as if the idea perceived were the natural and neceſſary effect of the action on the organ.

SENSE, a faculty of the ſoul whereby it perceives external objects, by means of ſome impreſſion made in the organs of ſenſe.

Some uſe the word ſenſe in a greater latitude; and define it a faculty whereby the ſoul perceives ideas or images of objects, either conveyed to it from without, by the impreſſion of objects themſelves, or excited within by ſome effort of the ſoul of the ſenſory itſelf.

Under which notion, ſenſe becomes diſtinguiſhable into two kinds, external and internal: correſponding to the two ſeveral manners wherein the images of the objects perceived are occaſioned, and preſented to the mind, viz. either immediately from without, or from within; that is, either by what we commonly call the five external ſenſes, hearing, ſeeing, &c. or by the internal ones, imagination, memory, and attention; to which ſome add hunger and thirſt.

But theſe internal ſenſes are not ordinarily conſidered in the notion of ſenſes, nor implied under the word ſenſe; but are thus only denominated by analogy.

The means, on the part of the mind, are always the ſame; it being one and the ſame faculty, whereby we ſee, hear, &c.— The means on the part of the body, are different; as different as are the objects we are concerned to perceive: for, the being and well-being of the animal being the end nature had in view in giving him any perception of external bodies, by this, the meaſure and manner of that perception is regulated: and we have ſo many ways of perceiving, and of perceiving ſo many things, as the relation we bear to external bodies renders neceſſary for the preſervation, &c. of our being.

Hence thoſe ſeveral organs of ſenſe, called eye, ear, noſe, palate, and the univerſal one cutis; each of which is ſo diſpoſed as to give ſome repreſentation and report to the mind of the ſtate of external things, the nearneſs, convenience, hurtfulneſs, and other habitudes; and each of them a different one, according to the degree, and immediateneſs, &c. of the danger, or conveniency. And hence the ſeveral exerciſes of thoſe organs, hearing, ſeeing, ſmelling, taſting, and feeling.

A late excellent author gives us a more ingenious, extenſive, and philoſophical notion of ſenſe. — On his principle, ſenſe is defined a power of perception, or a power of receiving ideas; if what is abſolutely paſſive may be properly called a power.

On ſome occaſions, inſtead of power, he chuſes to call it a determination of the mind to receive ideas. — The ideas thus perceived, or raiſed in the mind, he calls ſenſations. Senſe he conſiders, either as natural or moral: and the natural, either as external or internal; tho' the diſtribution is chiefly founded on the common ways of conceiving; for, in reality, they appear to be all natural and neceſſary: ſome reaſons, however, for the diſtinction, will be ſhewn under the ſeveral articles thereof.

External SENSES, the means whereby the ſoul takes cognizance of external objects. They are commonly reckoned five in number, viz. the eye, ear, noſe, palate, and cutis, or ſkin.

External ſenſes, then, are powers of perceiving ideas, upon the preſence of external objects. — On ſuch occaſions, we find the mind is merely paſſive, and has not power directly to prevent the perception, or idea, or to vary it at its reception; as long as the body is continued in a ſtate fit to be acted upon by the external object.

When two perceptions are intirely different from each other, or agree in nothing but the general idea of ſenſation; the power of receiving thoſe different perceptions is called different ſenſes. Thus ſeeing and hearing denote the different powers of receiving the ideas of colours and ſounds. And though colours, as well as ſounds, have vaſt differences amongſt themſelves; yet is there a greater agreement among the moſt oppoſite colours, than between any colour and a ſound; and hence all colours are deemed perceptions of the ſame ſenſe.

All the ſeveral ſenſes ſeem to have their diſtinct organs, except feeling, which is, in ſome degree, diffuſed over the whole body.

Internal SENSES, are powers or determinations of the mind to be pleaſed with certain forms and ideas, which occur to our obſervation in objects perceived by the external ſenſes.

Of theſe there are two different ſpecies, diſtinguiſhed by the different objects of pleaſure, viz. pleaſurable or beautiful forms of natural things, and pleaſurable or beautiful actions, or characters of rational agents: whence the internal ſenſes become diviſible into natural and moral; though what we call the internal natural ſenſe, our author call ſimply, and by way of eminence, the internal ſenſe.

In reflecting on our external ſenſes, we plainly ſee, that our perceptions of pleaſure, and pain, do not depend directly on our will. Objects do not pleaſe us according as we incline they ſhould; the preſence of ſome objects neceſſarily pleaſes us, and the preſence of others as neceſſarily diſpleaſes us; nor can we, by our will, any otherwiſe procure pleaſure, or avoid pain, than by procuring the former kind of objects, and avoiding the latter. By the very frame of our nature, the one is made the occaſion of delight, and the other of diſſatisfaction. In effect, our ſenſitive perceptions are pleaſant and painful, immediately, and without any knowledge of the cauſe of this pleaſure and pain, or of the manner how they excite it, or are occaſions of it, or without ſeeing to what further advantage, or detriment, the uſe of ſuch objects might tend. Nor would the moſt accurate knowledge of theſe things vary either the pleaſure, or the pain, of the perception; however it might give a rational pleaſure diſtinct from the ſenſible; or might raiſe a diſtinct joy, from proſpect of further advantage in the object, or averſion, from apprehenſion of evil. There is ſcarce any object, which our minds are employed about, but is conſtituted the neceſſary occaſion of ſome pleaſure or pain. Thus we ſhall find ourſelves pleaſed with a regular form, a piece of architecture or painting, a compoſition of notes, a theorem, an action, an affection, a character; and we are conſcious that this pleaſure naturally ariſes from the contemplation of the idea then preſent in the mind, with all its circumſtances, though ſome of thoſe ideas have nothing of what we call ſenſible perception in them; and, in thoſe which have, the pleaſure ariſes from ſome uniformity, order, arrangement, imitation; and not from the ſimple ideas of colour, or ſound, or mode of extenſion ſeparately conſidered.

It ſeems hence to follow, that, when inſtruction, education, or prejudice of any kind, raiſe any deſire or averſion towards an object, this deſire, or averſion, is founded on an opinion of ſome perfection, or deficiency, in thoſe qualities, for perception whereof we have the proper ſenſes. Thus, if beauty be deſired by one who has not the ſenſe of ſight; the deſire muſt be raiſed by ſome apprehended regularity of figure, ſweetneſs of voice, ſmoothneſs, ſoftneſs, or ſome other quality perceivable by the other ſenſes, without relation to the ideas of colour.

The only pleaſure of ſenſe, which our philoſophers ſeem to conſider, is that which accompanies the ſimple ideas of ſenſation; but there are vaſtly greater pleaſures in thoſe complex ideas of objects, which obtain the names of beautiful and harmonious. — The power, then, whereby we receive ideas of beauty and harmony, has all the characters of a ſenſe. It is no matter, whether we call theſe ideas of beauty and harmony perceptions of the external ſenſes of ſeeing and hearing, or not: we ſhould rather chuſe to call theſe ideas an internal ſenſe, were it only for the convenience of diſtinguiſhing them from other ſenſations of ſeeing and hearing, which men may have without perception of beauty and harmony.

Moral SENSE, a determination of the mind, to be pleaſed with the contemplation of thoſe affections, actions, or characters of rational agents, which we call good or virtuous.

This moral ſenſe of beauty, in actions and affections, may appear ſtrange at firſt view: ſome of our moraliſts themſelves are offended at it in my lord Shaftſbury, as being accuſtomed to deduce every approbation, or averſion, from rational views of intereſt. Our gentlemen of good taſte can tell us of a great many ſenſes, taſtes and reliſhes for beauty, harmony, imitation in painting and poetry; and may we not find, too, in mankind, a reliſh for a beauty in characters, in manners? The truth is, human nature does not ſeem to have been left quite indifferent, in the affair of virtue, to form to itſelf obſervations concerning the advantage or diſadvantage of actions, and accordingly to regulate its conduct. The weakneſs of our reaſon, and the avocations ariſing from the infirmity and neceſſities of our nature, are ſo great, that very few of mankind could have framed thoſe long deductions of reaſon, which may ſhew ſome actions to be, in the whole, advantageous, and their contraries pernicious. The Author of nature has much better furniſhed us for a virtuous conduct, than our moraliſts ſeem to imagine, by almoſt as quick and powerful inſtructions, as we have for the preſervation of our bodies; he has made virtue a lovely form, to excite our purſuit of it, and has given us ſtrong affections, to be the ſprings of each virtuous action.

SENSITIVE SOUL, a denomination given to the ſouls of brutes, or that which man is by ſome ſuppoſed to have in common with brutes.

SENSITIVE PLANT, in botany, a plant whoſe frame and conſtitution is ſo nice and tender, that on the touch or leaſt preſſure of the hand it will contract its leaves, as if ſenſible of the touch.

The ſtructure of the ſenſitive plant is this: from the large ſtems, or main branches of the whole, there part off ſeveral other leſſer ones, and from theſe there go off others ſtill leſs, which, by way of diſtinction, may be called the ribs of the leaves, as they ſerve to ſupport a number of leaves arranged on each ſide, and ſtanding on ſhort pedicles in pairs over-againſt one another. Several other plants have this ſort of compound leaves, as the caſſia, colutea, and the like; and all theſe ſhut their leaves together at night, and open them again in the morning, in the ſame manner as the ſenſitive plant does. This periodical opening and ſhutting of the leaves is therefore common to many plants, not peculiar to the ſenſitive plant; but the wonder in this is, that, beſides having this motion periodical and regular, it is to be brought on at other times, and by accidents, there requiring no more than the touching the plant to make it cloſe its leaves at any time of the day, which it ſoon afterwards naturally opens again. This is peculiar to this plant, and reſembles the action of an animal which had been injured or frightened. A cloſe obſervation alſo of the manner in which this is performed, will give many hints towards the finding its cauſe.

It is a very difficult thing to touch the leaf of a vigorous ſenſitive plant ſo lightly as not to make it cloſe. Its ſenſation is extremely delicate; and its large rib or nerve, which runs along its middle, is as it were a hinge, on which the two halves of the leaf move, when they turn upon being touched, till they ſtand erect, and by that means meet one another.

The ſlighteſt touch imaginable gives this motion to the ſide of the leaf which is touched, which is communicated immediately to the other ſide or half, and they move together; and, if the touch hath been a very little rougher, the oppoſite leaf on the ſame rib receives the impreſſion, and cloſes up in the ſame manner with that which was actually touched.

Nor is this all: for, when the two ſides of each of theſe leaves move upwards, the pedicle of each half moves upwards at the ſame time, and by this means they, in ſome meaſure, approach towards each other, and make the angles of their pedicles with the main rib, or ſtalk, of the compoſite leaf, leſs than before; and the total motion of each leaf is compoſed of theſe two motions.

If the touch be ſtill rougher, the whole arrangement of leaves on the ſame rib feel its influence on each ſide, and all cloſe in the ſame manner with the ſingle pair in the preceding inſtance; and, if the touch be yet ſtronger than this, the rib itſelf feels it, and attempts to cloſe in its way, moving itſelf upwards towards the branch from which it is produced, juſt as the ſingle pedicles of the leaves did towards it; and, if the touch be yet more hard and rough, the very branches have the ſenſation propagated to them, and apply themſelves to the main ſtem or trunk of the ſhrub, as the ſimple leaves did before to their rib, and that rib to the branch: ſo that the whole plant in this ſtate forms itſelf, from a very complexly-branched figure, into a ſort of ſtraight cylindric one. The motion which has, of all others, the greateſt effect upon this plant, is a ſhaking one.

Theſe three motions of the plant are performed by means of three diſtinct and ſenſible articulations; the firſt, that of the ſingle leaf to its pedicle; the ſecond, that of the pedicle to its branch; the third, that of the branch to the trunk. The primary motion of all which is the cloſing of the two halves of the leaf upon this rib, which ought alſo to be performed in a ſimilar manner, and by a ſimilar articulation; this, however, is much leſs viſible than the others.

Theſe motions are wholly independent on one another, as may be proved by experiment. It ſhould appear, that, if the ſtalks are moved and collapſe towards the branches, or theſe towards the trunk, that the leaves, whoſe motion is uſually primary to theſe, ſhould be affected alſo; yet experiment proves, that it is poſſible to touch the branches in ſuch a manner, as to affect them only, and make them apply themſelves to the trunk, while the leaves feel nothing of the touch: but this cannot be, unleſs the branches are ſo diſpoſed, as that they can fall to the trunk without ſuffering their leaves to touch any other part of the plant in their paſſage; becauſe, if they do, they immediately become affected. Winds and heavy rains cauſe the ſenſitive plants to ſhut up their leaves, while eaſy ſhowers do not at all affect them: it is plain from hence, that the agitation of the plant by the wind, and the ſtrokes given by the large and haſty drops of rain, are what cauſe the contraction.

By whatever accident the plant has been made to cloſe its leaves, it always regularly opens them again afterwards. This, however, requires different times, according to ſeveral circumſtances, as the time of the day, the ſeaſon of the year, and the more or leſs vigorous and healthy ſtate of the plant: ſometimes this is done in ten minutes, ſometimes it requires half an hour. And the manner is not leſs different than the time: for ſometimes the leaves unfold themſelves firſt, and ſometimes the branches; whereas ſometimes all is done at once, and the whole plant ſeems in motion at a time.

In endeavouring to account for the motions of this plant, Meſſ. Du Fay and Du Hamel have conjectured, that they are performed by means of a ſort of very nice and fine hinges, which communicate one with another by means of very minute and ſlender cords, which occaſion them to act as we ſee when the plant is ſufficiently diſturbed, and theſe cords ſhaken; and what gives a ſtrong probability to this conjecture is, that the decayed and dying leaves of this plant perform this motion as regularly and vigorouſly, as thoſe which are freſh and full of juice. It ſeems plain, that, while the juices are evaporating, and the parenchymatous ſubſtance of the leaves drying up, theſe more ſolid parts, the lines and cordages, retain their figure; and, conſequently, if it is, by means of theſe, that the motion is always performed, it will be as well performed in theſe as in the freſher leaves; which could not be the caſe, were it owing to the juices.

The natural opening and ſhutting of the leaves of this plant, at night and morning, are not ſo fixed but that they are variable alſo, according to circumſtances of place, temperature, &c. In the month of Auguſt, a ſenſitive plant was carried in a pot out of its uſual place into a dark cave; the motion that it received in the carriage ſhut up its leaves, and they did not open for twenty-four hours afterwards. At this time they became moderately open, but afterwards ſubject to no changes at night or morning, but remained three days and nights with their leaves in the ſame moderately open ſtate. At the end of this time they were brought out again into the air, and there recovered their natural periodical motions, ſhutting every night, and opening every morning, as naturally and as ſtrongly as if it had not been in this forced ſtate; and, while in the cave, it was obſerved to be very little leſs affected with the touch, than when abroad in the open air.

Repeated experiments have proved, that it is not the light of the day that opens theſe plants, nor the darkneſs of the night that cloſes them; neither is it the alternate warmth of the day, and cold of the night, that have this effect, ſince it ſhuts in nights that are much warmer than the days often are, in which it opens; and the increaſing the heat of the place in which it is kept, and marking the increaſe or decreaſe on the thermometer, have not been found to have the leaſt effect, as to its ſooner or later opening or ſhutting its leaves.

The moſt probable conjecture ſeems, that it is not great heat, or great cold, ſuch as it can bear, that brings on this effect, but the ſudden change from one to the other; and this is confirmed by this experiment: that, if one of theſe plants be raiſed under a glaſs bell or caſe, and the bell or covering be taken off, it immediately cloſes, even though it be in the middle of the day; and this is alſo obſerved, that, the more open or expoſed the plant ſtands, the more ſtrong and lively are its ſhutting and opening; and that they are moſt obſervable in ſummer, and much leſs ſo, when it is kept in a cloſe ſtove in winter.

The great heats of ſummer, when there is open ſunſhine at noon, affect the plant in ſome degree like cold, cauſing it to ſhut up its leaves a little, but never in any great

great degree. The plant, however, is leaſt of all affected about nine o'clock in the morning, and that is, conſequently, the propereſt time to make experiments on it. A branch of the ſenſitive plant, cut off and laid by, retains yet its property of ſhutting and opening in the morning for ſome days; and it holds it longer, if kept with one end in water, than if left to dry more ſuddenly.

The leaves only of the ſenſitive plant ſhut up in the night, not the branches; and, if it be touched at this time, the branches are affected in the ſame manner as in the day, ſhutting up, or approaching to the ſtalk or trunk, in the ſame manner, and often with more force. It is of no conſequence what the ſubſtance is with which the plant is touched, it anſwers alike to all; but there may be obſerved a little ſpot, diſtinguiſhable by its paler colour in the articulations of its leaves, where the greateſt and niceſt ſenſibility is evidently placed.

SENSORY, *Senſorium commune*, the ſeat of the common ſenſe, or what receives the impreſſions of all ſenſible objects, conveyed to it by the nerves of each particular organ, and conſequently is the immediate cauſe of perception. This office is by Dr. Willis, attributed to the ſtriated part of the brain, and by Des Cartes to the glandula pinealis.

SENTENCE, in law, a judgment paſſed in court by the judge on ſome proceſs, either civil or criminal.

SENTENCE, in grammar, a period or ſet of words comprehending ſome perfect ſenſe or ſentiment of the mind.

SENTENCE, in poetry, is an inſtructive and lively remark made on ſomething very obſervable, and agreeably ſurpriſing, which contains much ſenſe in few words.

SENTIMENTS, in poetry, and eſpecially dramatic, are the thoughts which the ſeveral perſons expreſs, whether they relate to matters of opinion, paſſion, buſineſs, or the like.

SENTINEL, CENTINEL, or CENTRY, in military affairs, is a private ſoldier placed in ſome poſt to watch any approach of the enemy, to prevent ſurprizes, and to ſtop ſuch as would paſs without order, or diſcovering who they are.

SEPARATING GLASS, in chemiſtry, a receiver having a ſpout at the bottom, for ſeparating oil from water, in diſtillation. See the article CHEMICAL LABORATORY (plate XXXIX. *fig.* 33.).

SEPARATISTS, an appellation given to diſſenters, from their ſetting up a ſeparate church from the eſtabliſhed one.

SEPTEMBER, the ſeventh month of the year, reckoning from the vernal equinox, or the ninth from January.

SEPTENTRIO, in aſtronomy, a conſtellation more uſually called urſa minor. See URSA.

SEPTICS, among phyſicians, an appellation given to all ſuch ſubſtances as promote putrefaction.

From the many curious experiments made by Dr. Pringle to aſcertain the ſeptic and antiſeptic virtue of natural bodies, it appears that there are very few ſubſtances of a truly ſeptic nature. Thoſe commonly reputed ſuch by authors, as the alcaline and volatile ſalts, he found to be no wiſe ſeptic. However, he diſcovered ſome, where it ſeemed leaſt likely to find any ſuch quality; theſe were chalk, common ſalt, and the teſtaceous powders. He mixed twenty grains of crabs eyes, prepared with ſix drams of ox's gall, and an equal quantity of water. In another phial he put an equal quantity of gall and water, but no crabs-eyes. Both theſe mixtures being placed in the furnace, the putrefaction began much ſooner where the powder was, than in the other phial. On making a like experiment with chalk, its ſeptic virtue was found to be much greater than that of the crabs-eyes: nay, what the doctor had never met with before, in a mixture of two drams of fleſh with two ounces of water and thirty grains of prepared chalk, the fleſh was reſolved into a perfect mucus in a few days.

To try whether the teſtaceous powders would alſo diſſolve vegetable ſubſtances, the doctor mixed them with barley and water, and compared this mixture with another of barley and water alone. After long maceration by fire, the plain water was found to ſwell the barley, and turn mucilaginous and ſour; but that with the powder kept the grain to its natural ſize, and though it ſoftened it, yet made no mucilage and remained ſweet.

Nothing could be more unexpected, than to find ſea-ſalt a haſtener of putrefaction, but the fact is thus: one dram of ſalt preſerves two drams of freſh beef in two ounces of water, above thirty hours, uncorrupted, in a heat equal to that of the human body; or, which is the ſame thing, this quantity of ſalt keeps fleſh ſweet twenty hours longer than pure water. But then half a dram of ſalt does not preſerve it above two hours longer. Twenty-five grains have little or no antiſeptic virtue, and ten, fifteen, or even twenty grains manifeſtly both haſten and heighten the corruption. The quantity, which had the moſt putrefying quality, was found to be about ten grains to the above proportion of fleſh and water.

Many inferences might be drawn from this experiment. One is, that ſince ſalt is never taken in aliment beyond the proportion of the corrupting quantities, it would appear that it is ſubſervient to digeſtion, chiefly by its ſeptic virtue, that is, by ſoftening and reſolving meats: an action very different from what is commonly believed.

It is to be obſerved that the above experiments were made with the ſalt kept for domeſtic uſes. *Pringle's Obſerv. on Diſ. of the Army.*

SEPTUAGESIMA, in the calendar, the third Sunday before Lent.

The word is formed from the Latin, *ſeptuaginta*, ſeventy; becauſe about ſeventy days before Eaſter.

SEPTUAGINT, LXX, or *The Seventy*, the name of a famous verſion of the Old Teſtament, out of Hebrew into Greek, performed by ſeventy-two Jewiſh interpreters, in obedience to an order of Ptolemy Philadelphus.

This verſion was in uſe at the time of our Bleſſed Saviour, and is that out of which all the citations in the New Teſtament, from the original Greek of the Old, are taken. It was the ordinary and canonical tranſlation made uſe of by he Chriſtian church in the earlieſt ages; and it ſtill ſubſiſts in the churches both of the Eaſt and Weſt. The hiſtory of this verſion is expreſsly written by Ariſteas, an officer of the guards to Ptolemy Philadelphus. The ſubſtance of this author's account of the Septuagint is as follows.

Ptolemy having erected a very fine library at Alexandria, took care to fill it with the moſt curious and valuable books from all parts of the world. Being informed, that the Jews had one, containing the laws of Moſes, and the hiſtory of that people, he formed the deſign of getting it tranſlated out of Hebrew into Greek, to enrich his library therewith. To this purpoſe it was neceſſary to apply to the high-prieſt of the nation: but this was attended with a great difficulty. There was in Egypt a great number of Jews reduced to ſlavery by his father Ptolemy Soter, in the invaſions he had made into Judea. It was repreſented to the king, that it was in vain to expect from the Jews a copy, or a faithful tranſlation of their law, whilſt he detained ſo great a number of their countrymen in ſervitude. Ptolemy, who was extremely generous, and had very much at heart the improvement of his library, immediately ſet at liberty all the Jews in his dominions. After ſuch a ſtep, he eaſily obtained what he deſired of the Jewiſh high-prieſt, named Eleazar, who ſent back his ambaſſadors with an exact copy of the Moſaical law written in letters of gold, and ſix elders of each tribe, in all ſeventy-two, to tranſlate it into Greek. Theſe deputies were received with all the marks of reſpect by the king, and then conducted into the iſle of Pharos, and lodged in a houſe prepared for their reception, where they were ſupplied with every thing neceſſary in abundance. They ſet about the tranſlation without loſs of time, and finiſhed it in ſeventy-two days. The whole was read, and approved, in the preſence of the king, who admired the profound wiſdom of the laws of Moſes, and ſent back the deputies loaden with preſents for themſelves, the high-prieſt, and the temple.

The hiſtorian has added many other circumſtances, which, becauſe they appear to be leſs probable, we ſhall omit. But it muſt not be diſſembled, that this work of Ariſteas is thought by many learned men to be ſpurious; and

that the writers, whether Jews, as Ariſtobulus, Philo, and Joſephus; or Chriſtians, as Juſtin Martyr, Clemens Alexandrinus, Irenæus, Hilary, Auguſtin, and ſome others, who have reported the fact of the verſion of the Septuagint; have done it upon the ſingle authority of Ariſteas. Some of theſe writers have added circumſtances which are too marvellous to deſerve any credit. Thus Philo tells us, that each of them tranſlated the whole Bible ſeparately, and yet there was not the minuteſt difference either in ſenſe or expreſſion, between their ſeveral tranſlations; whence he concludes, that they were all directed by the ſpirit of God. And Juſtin Martyr, and the other fathers, aſſure us, that they worked in ſeparate cells, and had no communication with each other; notwithſtanding which, their tranſlations were found to be exactly uniform and agreeable to each other. The reader may conſult the learned Dr. Prideaux, who has fully treated of this ſubject. What is certain is, that there was a Greek tranſlation of the Scriptures made in Egypt, in the time of the Ptolemies, and that this very verſion is extant among us under the title of the Septuagint.

Philo tells us, that the Jews of Egypt were ſo tranſported upon the making this tranſlation of the Scriptures into Greek; that they kept an annual feaſt in memory of it; at which time they went into the iſle of Pharos, and performed their devotions, out of reſpect to a place, which had been ſanctified by the preſence of the ſeventy interpreters. On the contrary, the Jews of Paleſtine conceived ſo much contempt and abhorrence for this verſion, that they faſted on the eighth day of Thebet, to ſhew how much they diſapproved the liberty that had been taken in tranſlating the law into a foreign and impure language.

We ſhall ſubjoin M. Rollin's reflection on this tranſlation of the Bible into Greek. "This verſion, which made the ſcriptures intelligible to an infinite number of people, was one of the moſt conſiderable fruits of the Grecian conqueſts: and it appears plainly to have been a part of the principal deſign, which God had in delivering all the Eaſt into the hands of the Greeks, and ſupporting them therein, notwithſtanding the diviſions, jealouſies, battles, and the frequent revolutions that happened among them. God by this means prepared an eaſy way for the preaching of the goſpel, which was near at hand, and more readily united ſo many nations, different both in language and manners, in one ſociety, in the ſame worſhip, and in the ſame doctrine, by one language, the moſt elegant, copious, and correct, that was in the world, and which became common to all the countries conquered by Alexander."

Chronology of the SEPTUAGINT, is an account of the years of the world, very different from what is found in the Hebrew text and the Vulgate, making the world 1466 years older than theſe latter.

SEPTUM, a Latin word, literally ſignifying a partition or incloſure, and, in anatomy, is applied to ſeveral parts of the body, which ſerve to ſeparate one part from another.

SEPULCHRAL, ſomething belonging to the ſepulchres, or tombs.

SEPULCHRE, a tomb or place deſtined for the interment of the dead. It is chiefly uſed in ſpeaking of the burying-places of the antients; thoſe of the moderns are uſually called tombs.

Regular Canons of ST. SEPULCHRE, a religious order, formerly inſtituted at Jeruſalem, in honour of the holy ſepulchre, or the tomb of Jeſus Chriſt.

Knights of the holy SEPULCHRE, a military order, eſtabliſhed in Paleſtine about the year 1114.

SEQUEL, in logic, a conſequence drawn from ſome preceding propoſition.

SEQUESTRATION, in common law, the act of ſeparating a thing in controverſy from the poſſeſſion of both parties, till the right be determined by courſe of law.

SEQUIN, ZECHIN, or ZECCHINO, a gold coin ſtruck at Venice, and ſeveral parts of the grand ſeignior's dominions, particularly at Cairo. The value of theſe ſequins is different, thoſe of Venice exceeding thoſe of Turky by nearly one fifteenth part,

SERAGLIO, among the Orientals, the palace of a prince or lord, but it is uſed by way of excellence for the palace of the grand ſeignior at Conſtantinople.

SERAPH, or SERAPHIM, in theology, a ſpirit of the firſt or higheſt rank.

The word is formed from the Hebrew שרף, to burn, or inflame; becauſe they are ſuppoſed to be moſt inflamed with divine love.

SERAPHIC, burning or inflamed with love or zeal, like a ſeraphim: thus St. Bonaventure is called the ſeraphic doctor, from his abundant zeal and fervor.

SERENADE, a kind of concert given in the night, by a lover to his miſtreſs, under her window.

SERENE, a quality or title of honour given to certain princes and chief magiſtrates of republics.

SERGE, in commerce, a woollen ſtuff manufactured in the loom, the warp of which is compoſed of the longeſt, and the woof of the ſhorteſt wool.

SERGEANT *at Law*, or *of the coif*, is the higheſt degree taken in the common law, as that of doctor is in the civil law.

SERGEANT *at Arms*, is an officer appointed to attend the perſon of a king, arreſt traitors and perſons of quality offending, and to attend the lord ſteward when he ſits in judgment on any traitor.

SERGEANT, or SERJEANT, in the army, is an inferior officer in a company of foot, or troop of dragoons; armed with a halberd, and appointed to ſee diſcipline obſerved, to teach the ſoldiers the exerciſe of their arms, to ſee due diſtance kept, to form ranks, files, &c.

SERGEANTRY, or SERJEANTRY, in law, is taken for a ſervice that cannot be due from a tenant to any other lord beſides the king.

SERJANIA, a name given to a genus of plants by father Plumier, who diſcovered them in America, in honour to the reverend father Philip Serjeant, who was of the order of the Minims, and a perſon well verſed in the knowledge of botany and phyſic.

The characters of the genus are: it hath a roſe-ſhaped flower, conſiſting of four or more leaves, which are placed in a circular order: from whoſe flower-cup ariſes the pointal, which afterwards becomes a fruit compoſed of three cells having three wings, and each cell containing one round reed.

SERIES, a continued ſucceſſion of things in the ſame order, and which have ſome relation to, or connection with each other.

SERIES, in algebra, a rank or progreſſion of quantities, increaſing or decreaſing in ſome conſtant ratio: which, in its progreſs, approaching ſtill nearer and nearer ſome ſought valve, is called a converging ſeries, and, if infinitely continued, becomes equal to that quantity; whence the uſual appellation infinite ſeries. See PROGRESSION.

The method of ſeries took its riſe from the learned Dr. Wallis's arithmetic of infinites, and has of late been ſo purſued by the greateſt mathematicians, that it is now one of the greateſt improvements in algebra.

Nature and Uſe of infinite SERIES. — Though arithmetic furniſhes us with very adequate and intelligent expreſſions for all rational numbers, yet it is very defective as to irrational ones, which are infinitely more numerous than the other; there being, for inſtance, an infinity of them between one and two, were it now required to find a mean proportional between 1 and 2, in rational numbers which alone are clearly intelligible (the root of 2 being certainly a very obſcure idea) we could ſtill approach nearer and nearer to the juſt value of the quantity required, but without ever arriving at it: thus, if for the mean proportional between 1 and 2, or the root of 2, we firſt put 1, it is evident we have not put enough; if we add $\frac{1}{2}$, we put too much, for the ſquare of $1 + \frac{1}{2}$ is greater than two. If then we take away $\frac{1}{3}$, we ſhall find we have taken away too much, and if we return $\frac{1}{16}$, the whole will be too great: thus may we proceed, without ever coming at the juſt quantity ſought.—Theſe numbers thus found, and thoſe found after the ſame manner to infinity, being diſpoſed in their natural order, make what we call an infinite ſeries.

Sometimes the ſeries's do not proceed by alternate additions and ſubtractions, but by ſimple additions, or an in-

infinity of ſubtractions, according to the poſition of the firſt term. In all theſe infinite ſeries's it is viſible, that, as all the terms are only equal to a finite magnitude, they muſt be ſtill decreaſing; and it is even convenient that they be ſo, as much as poſſible, that one may take only a certain number of the firſt terms for the magnitude ſought, and neglect all the reſt.

But it is not irrational numbers only, that are expreſſed in rational ones, by infinite ſeries's. Rational numbers themſelves may be expreſſed in the ſame manner: 1, for inſtance, being equal to the ſeries $\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}$, &c. but there is this difference between them, that whereas irrational numbers can only be expreſſed in rational numbers, by ſuch ſeries; rational ones need no ſuch expreſſion.

Among infinite ſeries's, there are ſome whoſe terms only make a finite ſum: ſuch is the geometrical progreſſion $\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}$, &c. and in general, all geometrical decreaſing progreſſions: in others, the terms make an infinite ſum; ſuch is the harmonical progreſſion $\frac{1}{2}\ \frac{1}{3}\ \frac{1}{4}\ \frac{1}{5}$, &c. See HARMONICAL. It is not that there are more terms in the harmonical, than in the geometrical progreſſion, though the latter has no term which is not in the former, and wants ſeveral the former has; ſuch a difference would only render the two infinite ſums unequal, and that of the harmonical progreſſion the greateſt: the cauſe lies deeper.

From the received notion of infinite diviſibility, it follows, that any finite thing, e. gr. a foot, is a compound both of finite and infinite: finite, as it is a foot: infinite as it contains an infinity of parts, into which it is diviſible. If theſe infinite parts be conceived, as ſeparated from one another, they will make an infinite ſeries, and yet their ſum only be a foot: only, no terms are to be here put, but ſuch as may, diſtinct from each other, be parts of the ſame finite whole: now this is the caſe in the geometrical decreaſing ſeries $\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}$, &c. for it is evident, that, if you firſt take $\frac{1}{2}$ of a foot, then $\frac{1}{2}$ of what remains, or $\frac{1}{4}$ of a foot, then $\frac{1}{2}$ of what remains, or $\frac{1}{8}$ of a foot; you may proceed to infinity, ſtill taking new decreaſing halves, all diſtinct from each other, and which all together only make a foot.

In this example, we not only take no parts but what were, in the whole, diſtinct from each other; but we take all that were there; whence it comes to paſs, that their ſum makes the preciſe whole again; but were we to follow the geometrical progreſſion $\frac{1}{3}\ \frac{1}{9}\ \frac{1}{27}$, &c. that is, at firſt take $\frac{1}{3}$ of a foot, and from what remains $\frac{1}{9}$ of a foot, and from what ſtill remains $\frac{1}{27}$ of a foot, &c. it is true, we ſhould take no parts but what were diſtinct from each other in the foot; but we ſhould not take all the parts that were there, ſince we only take the ſeveral thirds, which are leſs than the halves; of conſequence, all theſe decreaſing thirds, tho' infinite in number, could not make the whole; and it is even demonſtrated, that they would only make half. In like manner, all the fourths, decreaſing to infinity, would only make one third, and all the hundredths, only the ninety-ninth part: ſo that the ſum of the terms of an infinite ſeries, decreaſing geometrically, is not only always finite, but may even be leſs than any finite quantity that can be aſſigned.

If an infinite decreaſing ſeries expreſs parts which cannot ſubſiſt in the whole, diſtinctly from each other; but ſuch as, to take their values, we muſt ſuppoſe the ſame quantity taken ſeveral times, in the ſame whole; then will the ſum of theſe parts make more than a whole, nay, infinitely more; that is, the ſeries will be infinite, if the ſame quantity be taken an infinity of times.—Thus, in the harmonical progreſſion $\frac{1}{2}\ \frac{1}{3}\ \frac{1}{4}$, &c. if we take $\frac{1}{2}$ of a foot, or 6 inches, then $\frac{1}{3}$ 4 inches, it is evident we cannot take further $\frac{1}{4}$ of a foot, or 3 inches, without taking 1 inch more than was left in the foot. Since then the whole is already exhauſted by the three firſt terms, we can take no more of the following terms, without taking ſomething already taken: and, ſince thoſe terms are infinite in number, it is very poſſible that the ſame finite quantity may be repeated an infinite number of times, which will make the ſum of the ſeries infinite.

We ſay poſſib'e; for though of two infinite ſeries's the one may make a finite ſum, and the other an infinite; it is true that there may be ſuch a ſeries, where, the finites having exhauſted the whole, the following ones, though infinite in number, ſhall only make a finite ſum; and, in effect, ſince it is demonſtrated, by the laws of geometrical progreſſion, that there are ſeries's, whoſe ſums are leſs than the whole, nay, infinitely leſs, it follows, that there muſt likewiſe be ſeries's which make infinitely more.

There are two further remarks neceſſary to be made on ſeries's in general. 1. That there are ſome, wherein, after a certain number of terms, all the other terms, though infinite in number, become each a cypher. Now it is evident, the ſum of theſe ſeries's is finite, and eaſily found; they having only an appearance of infinity.

2°. That the ſame magnitude may be expreſſed by different ſeries's; and may be expreſſed both by a ſeries, whoſe ſum may be found, and by another, whoſe ſum cannot be found.

Geometry does not labour under the ſame difficulty as arithmetic: it expreſſes irrational numbers exactly in lines, and needs not have recourſe to infinite ſeries's. Thus the diagonal of a ſquare, whoſe ſide is 1, is known to be the ſquare root of 2.—But, in ſome other caſes, geometry itſelf is under the like embarraſs; there being ſome right lines, which cannot be expreſſed otherwiſe than by an infinite ſeries of ſmaller lines, whoſe ſum cannot be found: of which kind are the right lines equal to curves; ſo that in ſeeking, for inſtance, a right line equal to the circumference of a circle, we find, that, the diameter being 1, the line ſought will be $\frac{4}{1}$, minus $\frac{4}{3}$, plus $\frac{4}{5}$, minus $\frac{4}{7}$, plus $\frac{4}{9}$, &c.

As to the finding of an infinite ſeries to expreſs quantities ſought, Mercator, the firſt inventor of the method, did it by diviſion: but Sir Iſaac Newton and M. Leibnitz have improved the doctrine very conſiderably: the firſt finding his ſeries by the extraction of roots, and the ſecond by another ſeries preſuppoſed.

To find a SERIES *expreſſing a Quantity ſought by Diviſion.* Divide the dividend by the diviſor, as in common algebra, continuing the diviſion till the quotient ſhew the order of progreſſion, or the law, according to which the terms proceed to infinity.—

For example. Suppoſe $y + y\,x = v$, then $y = \frac{v}{1+x}$.

Then, by dividing v by $1 + x$ according to the common rules for the diviſion of algebra, we ſhall diſcover the law of the ſeries; as is plain from the following operation:

$$1+x)\ v(v - vx + vxx - vx^3 + vx^4, \text{ \&c}$$
$$v + vx$$
$$-vx$$
$$-vx - vxx$$
$$+vxx$$
$$+vxx + vx^3$$
$$-vx^3$$
$$-vx^3 - vx^4$$
$$+vx^4, \text{ \&c.}$$

And, by the ſame method of inveſtigation, of $yb \mp yx = aa$, we ſhall find $y = \frac{aa}{b \mp x} = \frac{a}{b} \mp \frac{a^2 x}{b^2} + \frac{a^2 x^3}{b^3} \pm \frac{a^2 x^3}{b^4} + \frac{a^2 x^4}{b^5}$, &c.

To find the ſum of the geometrical progreſſion $1 + x + x^2 + x^3, + x^p$. Put $s = 1 + x + x^2 + x^3, + x^p$; then $sx = x + x^2 + x^3 + x^4, + x^p + x^{p+1}$, and therefore, by ſubtraction, we have $s - sx = 1 - x^{p+1}$; conſequently $s = \frac{1 - x^{p+1}}{1-x}$. If x be a proper fraction and p infinite, then x^{p+1} being infinitely ſmall, or leſs than any quantity aſſignable, the ſum of $1 + x + x^2 + x^3$, &c. in infinitum, becomes $\frac{1}{1-x}$.

To find the ſum (s) of $1 + 2x + 3x^2 + 4x^3, \overline{p+1} \times x^p$. Here sx is equal to $x + 2x^2 + 3x^3 + 4x^4, + \overline{p+1} \times x^p + \overline{p+1} \times x^{p+1}$, and therefore $s - sx = 1 + x + x^2 + x^3, \overline{p+1} \times x^p - \overline{p+1} \times x^{p+1}$, and $s = \frac{1 + x + x^2 + x^3, + x^p - \overline{p+1} \times x^{p+1}}{1-x}$.

But $1+x+x^2+x^3, \ldots +x^p$ is equal to $\frac{1-x^{p+1}}{1-x}$, which being ſubſtituted in the above value of s, gives $\frac{1-x^{p+1}}{1-x^2} - \frac{\overline{p+1}\times x^{p+1}}{1-x}$, for the ſum of the ſeries $1+2x+3x^2+4x^3, \ldots \overline{p+1}\times x^p$. If x be leſs than unity, and p infinite, the ſum of the infinite ſeries $1+2x+3x^2+4x^3$, &c. will be expreſſed by $\frac{1}{1-x^2}$, becauſe $\frac{\overline{p+1}\times x^{p+1}}{1-x}$ being (when p is infinite) infinitely ſmall, may be rejected as inconſiderable.

Let it be required to find the ſum of the ſeries $1+ax+\overline{a+b}\times x^2+\overline{a+2b}\times x^3+\overline{a+3b}\times x^4, \ldots \overline{a+\overline{p-1}\times b}\times x^p$. By an actual multiplication of the terms of the ſeries we ſhall have $1+ax+ax^2+ax^3+ax^4+ax^5, \ldots +ax^p+bx^2+2bx^3+3bx^4+4bx^5, \ldots +\overline{p-1}\times b\times x^p$.

Now in order to find the ſum of the terms of the firſt part of the ſeries, put $s=x^2+x^3+x^4, \ldots +x^p$, then $sx=x^2+x^3+x^4, \ldots x^{p+1}$, and therefore $s-sx=x-x^{p+1}$: hence $s=\frac{x-x^{p+1}}{1-x}$, and the ſum of $1+ax+ax^2+ax^3+ax^4, \ldots +ax^p$, becomes $1+a\times\frac{x-x^{p+1}}{1-x}$. Our next buſineſs is to inveſtigate the ſum of the ſecond part of the ſeries, viz. $bx^2+2bx^3+3bx^4+4bx^5, \ldots +\overline{p-1}\times b\times x^p$; in order to which put $s=x^2+2x^3+3x^4, \ldots +\overline{p-1}\times x^p$, then $sx=x^3+2x^4+3x^5, \ldots +\overline{p-1}\times x^p+\overline{p-1}\times x^{p+1}$. Hence we get $s-sx=x^2+x^3+x^4+x^5, \ldots +x^p-\overline{p-1}\times x^{p+1}$. For $x^2+x^3+x^4+x^5, \ldots +x^p$, ſubſtitute its value $\frac{x^2-x^{p+1}}{1-x}$, and we ſhall have $s=\frac{x^2-x^{p+1}}{1-x^2}-\frac{\overline{p-1}\times x^{p+1}}{1-x}$, conſequently the ſum of the propoſed ſeries $1+ax+\overline{a+b}\times x^2+\overline{a+2b}\times x^3+\overline{a+3b}\times x^4, \ldots +a+\overline{p-1}\times b\times x^p$, will be expounded by $1+a\times\frac{x-x^{p+1}}{1-x}+b\times\frac{x^2-x^{p+1}}{1-x^2}-b\times\frac{\overline{p-1}\times x^{p+1}}{1-x}$.

In the ſame manner may the ſum of the ſeries $\frac{m-1}{rm}+\frac{m-2}{r^2m}+\frac{m-3}{r^3m}+\frac{m-4}{r^4m}$, &c. continued to m number of terms, or of the ſeries $\frac{\overline{m-1}\times\overline{n-1}}{rmn}+\frac{\overline{m-2}\times\overline{n-2}}{r^2mn}+\frac{\overline{m-3}\times\overline{n-3}}{r^3mn}$, &c. continued to m number of terms, be eaſily found, and are reſpectively equal to $\frac{1}{r-1}-\frac{r+r^{1-m}}{m\times\overline{r-1}^2}$ and $\frac{1}{r-1}+\frac{2r-2r^{1-m}}{mn\times\overline{r-1}^3}-\frac{\overline{m+n-1}\times r+\overline{n-m-1}\times r^{1-m}}{mn\times\overline{r-1}^2}$.

To Find a SERIES *Expreſſing the Quantity ſought, by Extraction of roots.*—Suppoſe $yy=1-xx$, then, by extracting the root on each ſide of the equation according to the common rules, we ſhall find $y=1-\frac{1}{2}x^2-\frac{1}{8}x^4-\frac{1}{16}x^6-\frac{5}{128}x^8-\frac{7}{256}x^{10}$, &c. See BINOMIAL *Theorem.*

Reverſion of SERIES, the extracting the root of an infinite equation.

SERMONES, the title Horace gives to his ſatires.

The critics are divided about the reaſon of the name. The opinion of father Boſſu ſeems well grounded; a mere obſervation of feet and meaſure, ſuch as we find in Plautus, Terence, and in Horace's ſatires, he thinks, is not ſufficient to conſtitute verſe; to determine the work to be poetical, or diſtinguiſh it from proſe; unleſs it have ſome farther air or character of poetry, ſomewhat of the fable, or ſublime. Hence it is that Horace calls his ſatires proſe Sermones.

SERMONS, orations, or diſcourſes delivered by the clergy of the Chriſtian church, in their religious aſſemblies.

In the ancient church, immediately after the reading of the pſalms, and leſſons out of the ſcriptures, before the catechumens were diſmiſſed, followed the ſermon, which the biſhop or ſome other, appointed by him, made to the people. This, being done in the preſence of the catechumens, was therefore reckoned a part of the *miſſa catechumenorum*, or ante-communion ſervice. Such diſcourſes were commonly termed homilies, ομιλιαι, which ſignifies indifferently any diſcourſe of inſtruction to the people. Amongſt the Latins they were frequently called *tractatus*, and the preachers *tractatores*.

Preaching, anciently, was one of the chief offices of a biſhop; inſomuch that, in the African churches, a preſbyter was never known to preach before a biſhop in his cathedral church, till St. Auſtin's time. In the Eaſtern church, preſbyters were indeed allowed to preach before the biſhop; but this was not to diſcharge him of the duty, for ſtill he preached a ſermon at the ſame time after them. In the leſſer churches of the city and country, the office of preaching was devolved upon the preſbyters; but deacons never were allowed to perform it. There are numberleſs paſſages in the writings of the fathers, which ſpeak of preaching as a duty indiſpenſably incumbent on a biſhop. Many canons of councils either ſuppoſe, or enjoin it: and, in the imperial laws, there are ſeveral edicts of the ſecular power to the ſame purpoſe.

It has been a queſtion, whether laymen were ever allowed by authority to make ſermons to the people. It is certain, they did it in a private way, as catechiſts, in their catechetic ſchools at Alexandria, and other places; but this was a different thing from public preaching in the church. Sometimes the monks, who were only laymen, took upon them to preach; but this was cenſured, and oppoſed, as an uſurpation of an office that did not belong to them. Yet, in ſome caſes, a ſpecial commiſſion was given to a layman to preach: as in the caſe of Origen, who was licenſed by Alexander, biſhop of Jeruſalem, to preach and expound the ſcriptures in the church, before he was in orders. As to women, whatever gifts they could pretend to, they were never allowed to preach publicly in the church; agreeably to the apoſtolic rule, "Let your women keep ſilence in the churches, &c." But they might teach thoſe of their own ſex, as private catechiſts, and prepare them for baptiſm. And this was the office of the deaconeſſes. The Montaniſts were a noted ſect for giving the liberty of preaching to women, under the pretence of inſpiration by the ſpirit; for they had propheteſſes, women-biſhops, and women-preſbyters.

Next to the perſons, the manner in which the office of preaching was executed, comes to be conſidered. And firſt it is obſervable, that they had ſometimes two or three ſermons preached in the ſame aſſembly, firſt by the preſbyters, and then by the biſhops. When two or more biſhops happened to be preſent in the aſſembly, it was uſual for ſeveral of them to preach, one after another, reſerving the laſt place for the moſt honourable perſon. In ſome places, they had ſermons every day, eſpecially in Lent, and the feſtival days at Eaſter. In many places, they had ſermons twice a day, for the better edification of the people. But this is chiefly to be underſtood of cities and large churches: for in the country pariſhes there was not ſuch frequent preaching.

The next thing to be obſerved is, their different ſorts of ſermons, and different way of preaching. Theſe are diſtinguiſhed into four kinds: 1. Expoſitions of ſcripture. 2. Panegyrical diſcourſes upon the ſaints and martyrs. 3. Sermons upon particular times, occaſions, and feſtivals. 4. Sermons upon particular doctrines, or moral ſubjects. There are examples of all theſe kinds in St. Chryſoſtom's and St. Auſtin's homilies, the two great ſtandards of preaching, in the Greek and Latin churches.

But,

But, though moſt of theſe were ſtudied and elaborate diſcourſes, penned and compoſed beforehand, yet ſome were alſo extempore, ſpoken without any previous compoſition, and taken down in ſhort-hand from the mouth of the preacher. Origen was the firſt that began the way of extempore preaching in the church.

Upon this account it was uſual for the preacher to uſher in his diſcourſe with a ſhort prayer, for divine aſſiſtance. In this ſenſe we are to underſtand St. Chryſoſtom, when he ſays, "We muſt firſt pray, and then preach." Sometimes, before they began to preach, they uſed the common ſalutation, *Pax vobis*, Peace be with you; to which the people anſwered, And with thy ſpirit. And ſometimes they prefaced the ſermon with a ſhort form of benediction, eſpecially in times of calamity and diſtreſs, or of happy deliverances out of them. Sometimes they preached without any text, and ſometimes upon more texts than one. Neither did they entertain their auditory with light and ludicrous matters, or fabulous and romantic ſtories, ſuch as thoſe with which preaching ſo much abounded in the age before the Reformation.

And, as they were careful in the choice of their ſubject, ſo were they in the manner of dreſſing it up, and delivering it, that they might anſwer the true ends of preaching. St. Auſtin has laid down excellent rules, for the practice of Chriſtian eloquence; and, if we will take his character of the ancient preachers, it was, in ſhort, this: that their diſcourſes were always upon weighty and heavenly matters, and their ſtyle anſwerable to the ſubject, being plain, elegant, majeſtic, and nervous; fitly adapted to inſtruct and delight, to convince and charm their hearers. It was no part of the ancient oratory to raiſe the affections of the auditory, either by geſticulations, or the uſe of external ſhews and repreſentations of things in their ſermons, that is now very common in the Romiſh church. As to the length of their ſermons, ſcarce any of them would laſt an hour, and many not half the time. And among thoſe of St. Auſtin there are many, which a man may pronounce diſtinctly, and deliver decently, in eight minutes. They always concluded their ſermons with a doxology to the Holy Trinity. And it is farther obſervable, that the preacher uſually delivered his ſermon ſitting, and the people heard it ſtanding; though there was no certain rule about this, but the cuſtom varied in different churches.

It was a peculiar cuſtom in the African church, when the preacher chanced to cite ſome remarkable text, in the middle of his ſermon, for the people to join with him in repeating the cloſe of it. St. Auſtin takes notice of this in one of his ſermons, where, having begun thoſe words of St. Paul, "The end of the commandment is"—the people all cried out, "Charity, out of a pure heart." But it was a much more general cuſtom for the people to teſtify their eſteem for the preacher, and approbation of his ſermon, by public applauſes, and acclamations in the church. Thus, we are told, the people applauded St. Chryſoſtom's ſermons, ſome by toſſing their garments, others moving their plumes, others laying their hands upon their ſwords; and others waving their handkerchiefs, and crying out, "Thou art worthy of the prieſthood, &c." Many of the auditors practiſed the art of notaries, and took down the ſermons of the moſt eminent preachers, word for word, as they delivered them. By this means ſome of their extempore diſcourſes were handed down to poſterity, which elſe would have died with the ſpeaking.

The Roman catholics call the ſermon, the prone. After the goſpel, the preacher goes to the bottom of the ſteps of the altar, on the epiſtle ſide, where he kneels down, and offers prayers to God for the action he is going about. Then he aſcends the pulpit; where he firſt bows to the croſs, and then to the chief of the congregation. He likewiſe croſſes himſelf; and, whenever he pronounces the name of Jeſus and Mary, he takes off his cap, and bows. In Italy, he does the ſame thing, whenever the reigning pope is named in the ſermon. Before the biſhop, or when the holy ſacrament is ſolemnly expoſed on the altar, it is uſual to preach bare-headed.

The manner of preaching in Italy is very indecent, the behaviour of the preachers being like that of ſtage-dancers: they are extravagant in their geſtures, they ſtrike with their hands and feet, roll their eyes, and walk from one end of the pulpit, which is very long and wide, to the other, with immoderate and ridiculous vivacity. Their fineſt ſermons. ſays a celebrated traveller, are thoſe that raiſe the moſt laughter. 'The Capuchins, adds he, never preach, but on terrible ſubjects; they ſeize their own beards, clap their hands, and ſcream enough to fright one. The other day, I heard a Carmelite, who was preaching to the repentant nuns of the holy croſs, on the ſubject of Mary Magdalen. In order to raiſe a more exalted idea of the ſacrifice his penitent had made of the pleaſures of the world, he ſpent a whole quarter of an hour in painting her out as the moſt charming creature under heaven: not one feature, in the moſt perfect body, was omitted; and he talked more like a moſt accompliſhed painter, than a preacher.' In Italy, there are ſeldom any ſermons, but in the time of Advent and Lent. The friars preach in their convents upon topics which we may call eternal; for they ſeldom loſe ſight of their founders, or of ſome particular practices, which they are fond of, ſuch as the roſary, and ſcapulary, and St. Francis's girdle. In ſome cities of Italy, are itinerant preachers, who carry about with them little moveable pulpits.

In Spain they often preach in the public ſquares and high ſtreets, and ſeldom fail of a numerous audience. The preachers take great pains to affect their hearers, and to this end they frequently ſtrike their breaſt or face, and the whole congregation does the ſame thing. They who draw moſt tears are thought the beſt preachers.

The Greek Chriſtians ſeldom have any ſermons. Preaching, as Tournefort aſſures, is ſo far aboliſhed, that there is ſcarce a pulpit to be ſeen in all their churches: however, when a father does attempt to mount the roſtrum, he delivers himſelf in the moſt awkward manner imaginable; and has two crowns for his diſcourſe, which conſiſts only of a tedious train of empty words, without the leaſt order or coherence, and which the preacher himſelf (ſays our author) underſtands no more than the people.

SERON *of Almonds*, is the quantity of 200 weight; of aniſe ſeeds, from 3 to 400; of Caſtile-ſope, from 200 and a half to 300 and 3 quarters.

SEROSITY, in medicine, an aqueous liquor, or lymph, found in the blood, and other humours.

SERPENS, in aſtronomy, a conſtellation of the northern hemiſphere, called more particularly, Serpens Ophiuchi. The ſtars in this conſtellation in Ptolemy's catalogue are 17, in Tycho's 19, and in Mr. Flamſtead's 59.

SERPENT, *Serpens*, in zoology, the name of a genus of animals, which Mr. Ray defines to be creatures breathing by means of lungs, having only one ventricle in the heart, having no feet, and having a long body, covered with ſcales. To which he adds, that in cold ſeaſons they can bear hunger a long time. The greater part of the ſerpent claſs are poiſonous, and dangerous in their bite, leaving a miſchievous liquor in the wound, made by their tooth, which, mixing by this means immediately with the blood, is of fatal conſequence; though the whole creature may be eaten with ſafety, or even the poiſonous liquor, which does this miſchief in the wounded, taſted without hurt.

Notwithſtanding that ſerpents reſpire by means of lungs, they do not take in and diſcharge their breath by ſuch ſhort intervals as other animals, but what they have once inſpired will ſerve them a long time; for as they are of a cold nature, and therefore their neceſſary warmth very ſmall, they do not require ſuch an eternally renewed ſupply of that pabulum of vital heat, as thoſe which have more of it; and as with us they lie half the year torpid, and half dead, their vital warmth at that time, like fire ſmothered under aſhes, barely exiſts, and needs perhaps no more air than what the creature took in at one inſpiration, before its laying itſelf down for the ſeaſon, which ſerves it till the life-renewing ſpring returns.

Serpents, according to Mr. Ray, may be divided into the poiſonous and the harmleſs; the firſt having long dentes exerti, with poiſonous liquors contained at their bottom, which, on biting, they diſcharge into the

wound

wound: the others wanting theſe teeth, and this poiſon.

They may alſo be divided, in regard to their generation, into the oviparous and viviparous; but this is a leſs firmly founded diſtinction than may be ſuppoſed, ſince all ſerpents are truly and properly produced of eggs; and the only difference is, that ſome depoſit their eggs in dunghills, and the like places, to be hatched by accidental heat, while others retain thoſe eggs to be hatched in their own bodies, and ſo bring forth living young ones. Of the firſt kind is the common ſnake, of the latter the viper. *Ray's Syn. Quad. et Sup.*

SERPENT, *Bubalinus*. Mr. Cleyer has given a very remarkable account, in the German Ephemerides, of the prodigious ſize and voracious appetite of this ſerpent, and its manner of feeding. This gentleman aſſures us that they grow to the length of five feet, and are ſurpriſingly daring in attacking large creatures for prey. Their neck, he obſerves, is ſo ſmall, in proportion to the creature they ſeize; that it is a wonder that they can ſwallow them whole, which yet experience ſhews they certainly do, having no power of tearing them to pieces. This gentleman ſaw a complete ſtag taken out of the belly of one of theſe ſnakes, with all its limbs remaining on: and at another time a wild goat which had been ſwallowed in the ſame manner, and from another a complete porcupine, a very troubleſome morſel; and there was once an inſtance, in the Molucca iſlands, of a woman big with child being thus ſucked down whole by one of theſe creatures. *Ray's Syn. An.*

The method of their managing their prey is this: when thoroughly lank, lean and hungry, the ſnake lies in wait for any thing it can ſeize; he darts out upon the prey, and, ſeizing it with his mouth, winds his body round that of the creature; and this he is able to do with ſuch force, that he will often, in twiſting himſelf firmly round the creature, break the bones within its ſkin. This he continues, and at the ſame time is biting, with his terrible mouth, all the tender parts of the creature, till he has deſtroyed it; or, if it be an animal too ſtrong to be killed by theſe ſimple folds, it will drag it to ſome neighbouring tree, and, tying it faſt againſt that, draw its body ſo forcibly round it, as to cruſh all its bones to pieces by the help of that ſolid reſiſting body. The part it uſually ſeizes with its teeth, at the ſame time, is the creature's noſe, which he bites ſo forcibly as not only to ſtop the breath, but to occaſion a diſcharge of blood, which helps to forward its deſtruction.

But the moſt ſingular attack, ever known to have been made by this creature, is that recorded by the ſame author, of its ſeizing a buffaloe, which it deſtroyed in the manner above deſcribed, though it was a long time about it, and was obliged to have recourſe to the method of tying it up to a tree, againſt which it broke its bones ſeverally, with a noiſe that was heard to a great diſtance. When the creature had thus deſtroyed its prey, it continued breaking of the bones, till there was not one left whole in the body, and the whole reſembled a ſhapeleſs maſs of matter.

The jaws and throat of this, and of the other ſerpent kind, though ſmall and narrow, are prodigiouſly extenſible, and made ſo by nature, for the ſwallowing theſe morſels. The ſnake, when the prey lay in this ſtate before it, licked it all over, and covered it thick with its ſaliva, and that ſo regularly, that the whole carcaſe looked as if daubed over with glue. This done, it opened its jaws to a monſtrous extent, and ſucked in the head of the prey, and continuing inceſſantly ſucking, at length drew down the whole body.

This is a work of time, and very often two or three days are employed in it. And, when the animal is thus got down, the ſnake is ſwelled and bloated up all over with it, and is no longer in a ſtate of offending, or even of defending itſelf, or ſo much as running away; and the people of the places where this ſpecies is common, well know this, and find it an eaſy thing to deſtroy them in this ſtate, and are very happy when they catch one, as their fleſh is a very delicate food. *Ephem. Germ. Ann.* 12 *Obſ.* 7.

SERPENT, in muſic, a wind inſtrument, ſerving as a baſs to the cornet, or a ſmall ſhawm, to ſuſtain a chorus of ſingers in a large veſſel. It had its name ſerpent from its figure, as conſiſting of ſeveral folds or wreaths, ſerving to take off its length, which would otherwiſe be ſix or ſeven feet: it is uſually covered with leather, and conſiſts of three parts: a mouth-piece, neck, and tail. It has ſix holes, by means of which they give it the compaſs of two octaves.

SERPENTARIA, VIRGINIAN SNAKEROOT: the root of a ſpecies of ariſtolochia growing in Virginia and Carolina. The root is ſmall, light, buſhy, compoſed of a number of ſtrings or fibres iſſuing from one head and matted together, of a browniſh colour on the outſide, and paler or yellowiſh within.

SNAKEROOT has an aromatic ſmell, approaching to that of valerian, but more agreeable, and a warm bitteriſh pungent taſte, which is not eaſily concealed or overpowered by a large admixture of other materials. It gives out its active matter both to water and rectified ſpirit, and tinges the former of a deep brown, the latter of an orange colour. Greateſt part of its ſmell and flavour is carried off in evaporation or diſtillation by both menſtrua: along with water there ariſes, if the quantity of the root ſubmitted to the operation be large, a ſmall portion of a pale coloured eſſential oil, of a conſiderable ſmell, but no very ſtrong taſte, greateſt part of the camphorated pungency, as well as bitteriſhneſs of the root, remaining in the inſpiſſated extract. The ſpirituous extract is ſtronger than the watery; not ſo much from its having loſt leſs in the evaporation, as from its containing the active parts of the root concentrated into a ſmaller volume; its quantity amounting only to about one half of that of the other.

This root is a warm diaphoretic and diuretic. It is reckoned one of the principal medicines of the alexipharmac kind; and as ſuch is in general uſe, in low malignant fevers and epidemic diſeaſes, for ſupporting the vis vitæ, raiſing the pulſe, promoting a diaphoreſis, and correcting a putrid diſpoſition of the humours. It is given, in ſubſtance, from a few grains to a ſcruple or half a dram; in decoction or infuſion, to a dram and upwards. Tinctures of it are prepared in the ſhops, by macerating two or three ounces of the root in a quart of proof ſpirit, or of a ſpirituous alexeterial water mixed with one ſixth its quantity of diſtilled viuegar, which laſt ingredient is an excellent addition to theſe kinds of medicines in acute diſeaſes.

SERPENTARIUS, in aſtronomy, a conſtellation of the northern hemiſphere, called alſo Ophiuchus. The ſtars in this conſtellation, in Ptolemy's catalogue, are 29, in Tycho's 25, and in Mr. Flamſtead's 69.

SERPENTINE, in general denotes any thing that reſembles a ſerpent; hence the worm or pipe of a ſtill, twiſted in a ſpiral manner, is termed a ſerpentine worm.

SERPENTINE MARBLE, a kind of marble ſpotted like the ſkin of a ſerpent, whence its name. The ancients called it ophites, from ὄφις, a ſerpent.

SERPENTINE VERSES, ſuch as begin and end with the ſame words.

SERPIGO, in medicine, a ſpecies of herpes, vulgarly called a ring-worm. See HERPES.

SERPYLLUM, *Mother of Thyme*, in botany, a ſpecies of thyme. See THYME.

SERRATED, in general, ſomething indented, or notched, in the manner of a ſaw.

SERRATUS, in anatomy, a name given to ſeveral muſcles of the body from their reſembling a ſerra or ſaw.—As

SERRATUS *anticus minor*, which ariſes thin and fleſhy, from the ſecond, third, fourth, and fifth ſuperior ribs; and aſcending obliquely, it is inſerted fleſhy into the proceſſus coracoides of the ſcapula, which it draws forward. It alſo helps in reſpiration.

SERRATUS *anticus major*; which comes from the whole baſis of the ſcapula, and is inſerted into the ſeven true ribs, and firſt of the falſe ribs, by ſo many diſtinct portions repreſenting the teeth of a ſaw.

SERRATUS *poſticus ſuperior*, ariſeth by a broad and thin tendon from the two inferior ſpines of the vertebræ of the neck, and the three ſuperior of the back; and, growing fleſhy, is inſerted into the ſecond, third, and fourth ribs by ſo many diſtinct indentations. Theſe two help

help to draw the ribs upwards, and bring them to right angles with the vertebræ; and, conſequently, make the cavity of the thorax wider and ſhorter.

SERRATUS *poſticus inferior*, ariſes with a broad and thin tendon from the three inferior ſpines of the vertebræ of the back, and from the two ſuperior of the loins; its fibres, aſcending obliquely, grow fleſhy, and are inſerted by four indentations into the four laſt ribs.

SERVANT, a term of relation ſignifying a perſon who owes and pays a limited obedience for a certain time, to another in quality of maſter.

SERVETISTS, a name given to the modern anti-trinitarians, from their being ſuppoſed to be the followers of Michael Servetus, who in the year 1559, was burnt at Geneva, together with his books.

SERVICE, in law, is a duty which a tenant, by reaſon of his fee, owes to his lord.

SERVING, in the ſea-language, the act of winding a quantity of leather canvas, or cordage round any rope, to preſerve it from being galled or rubbed by the friction produced at ſea by the agitation of the ſhip on the waves. The materials applied to this purpoſe are termed ſervice. See PLAT. ROUNDING and FRESHEN.

SERVITES, a religious order in the church of Rome, ſo called from their peculiar attachment to the Bleſſed Virgin.

This order was founded by ſeven Florentine merchants, viz. Bonfils Monaldi, John Manetti, Benêt de Lantella, Bartholomey Amidei, Ricouere Lippe Uguccion, Gerardin Soſtegni, and Alexis Falconieri. Theſe gentlemen, with the approbation of the biſhop of Florence, renounced the world, and lived together, in a religious community, on Mount Senar, two leagues from that city. When they firſt appeared in the black habit given them by the biſhop, the very children at the breaſt cried out, "See the ſervants of the Virgin;" and this miracle determined them to take no other name than that of Servites, or ſervants of the Virgin.

Some time after, finding the diſtance of their ſolitude from Florence too inconvenient, on account of the neceſſity they were under of ſubſiſting by alms, they procured a little hoſpital or monaſtery to be built without one of the gates of the city: and this was the humble origin of the famous monaſtery of the Annunciado at Florence.

In length of time this order increaſed to ſuch a degree, that it became divided into twenty-ſeven provinces, and enjoyed ſeveral privileges by grants from the popes. Formerly they eat no fleſh meat, and obſerved ſeveral other auſterities, which afterwards they diſpenſed with. They boaſt of having produced ſeveral cardinals and other eminent perſons, eſpecially men of learning, among whom was the famous father Paul, who wrote the hiſtory of the council of Trent.

There are likewiſe nuns of this order, who have ſeveral monaſteries in Germany, Italy, and Flanders.

SERVITOR, in the univerſity of Oxford, a ſcholar, or ſtudent, who waits upon another for his maintenance there.

SERVITORS *of Bills*, ſervants or meſſengers of the marſhal of the King's-bench, ſent with bills or writs, to ſummon people to that court: theſe are now called tipſtaves.

SERUM, the thin watery part of the blood. See BLOOD.

The word is Latin, and literally ſignifies whey.

SERUM *Aluminoſum*, *alum-whey*, a form of medicine preſcribed in the late London Pharmacopœia, made of a pint of milk boiled to whey with a quarter of an ounce of alum.

SESSAMOIDEA OSSA, in anatomy, ſeveral ſmall bones placed between the joints of the fingers and toes.

The word is formed from the Greek, σησαμη, an Indian ſeed, and ειδος, reſemblance.

SESAMUM, the oily grain plant, in botany, a genus of plants, the flowers of which are produced from the wings of the leaves, without any foot-ſtalk; the flower-cup conſiſts of one leaf, divided into five long ſlender ſegments: the flower is of one leaf, in ſhape like thoſe of the fox-glove: the pointal, which riſes in the middle of the flower, afterwards becomes an oblong four-cornered pod, divided into four diſtinct cells, which are replete with eſculent ſeeds.

In England, theſe plants are preſerved in botanic gardens as curioſities. Their ſeeds muſt be ſown in the ſpring upon an hot-bed; and, when the plants are come up, they muſt be tranſplanted in a freſh hot-bed, to bring them forward. After they have acquired a tolerable degree of ſtrength, they ſhould be planted into pots, filled with rich light ſandy ſoil, and plunged into another hot-bed; for, if theſe plants are not brought forward thus in the former part of the ſummer, they will not produce good ſeeds in this country; though, after they have flowered, if the ſeaſon is favourable, they may be expoſed in a warm ſituation, with other annual plants. When theſe plants have perfected their ſeeds, they decay, and never continue longer than one ſeaſon.

SESELI-*Seed*, in the materia medica, the name of a ſeed of a plant, called alſo by ſome libanotis, and growing three or four feet high, with leaves like fennel, but of a paler green. It is a native of warm climates. The ſeed ſhould be choſen moderately large, of a longiſh ſhape, heavy, clean, and of a greeniſh colour, freſh, and of a grateful ſmell. It affords, by diſtillation, a very large quantity of an eſſential oil, and is hot and dry. It incides, opens, and diſcuſſes, and is cephalic, neurotic, pectoral, nephritic. It is good againſt epilepſies, apoplexies, vertigoes, and all diſorders of the head and nerves.

SESQUI, a Latin particle ſignifying a whole and a half; which, joined with *altera*, *terza*, *quarta*, &c. is uſed by the Italians in their muſic, to expreſs a kind of ratio's, particularly ſpecies of triple time.

SESQUI-ALTERAL PROPORTION, in geometry and arithmetic, is when any number or quantity contains another once and an half, and the number ſo contained in the greater, is ſaid to be to it in ſubſequi-alteral proportion.

SESQUI-DUPLICATE *Ratio*, in geometry and arithmetic, is when any number or quantity contains another twice and a half.

SESSILE *Roots*, in gardening, imply ſuch tuberoſe roots as adhere to the ſtalk.

SESSILE *Leaf*, a leaf fixed immediately to the ſtalk, or root, without any foot-ſtalk.

SESSION, the ſitting of an aſſembly or council.

SESTERCE, a ſilver coin in uſe among the ancient Romans; being the fourth part of the denarius, and originally contained two as's and a half; or ſomething more than ſeven farthings ſterling.

SET, or SETTS, a term uſed by farmers and gardeners to ſignify the young plants of the white-thorn, and other ſhrubs, with which they raiſe their quick-ſet hedges, &c.

The white-thorn is the beſt, of all trees, for this purpoſe, and under proper regulations, its ſets ſeldom fail of anſwering the farmer's utmoſt expectations.

The firſt thing to be conſidered by the perſon who is about to plant a quick-ſet hedge, is what nature the land is of where it is to ſtand, as whether it is clay, ſand, or gravel. It is always proper to take the ſets from a worſe land than that they are to be planted on, otherwiſe they will never grow well. The ſets are about the thickneſs of a man's thumb, and cut within four or five inches of the ground. If the quick is intended only for a hedge, without a bank or ditch, let the ſets be planted almoſt perpendicular in two rows, at about twelve inches diſtance from each other; and if there is to be a ditch and a bank, that is to be firſt provided. The ground is to be marked out with a line, and a ditch dug three feet wide at the top, one foot wide at the bottom, and two feet deep. When the ditch is digging, on that ſide where the quick is to ſtand, let the turf be laid evenly on the ground with the graſſy ſide downwards: upon this ſome fine mould is to be laid to bed the quick-ſets in, and they are to be laid upon it with their ends inclining upwards, and at about twelve inches aſunder. They muſt be carefully gathered, and ſuch as are ſtraight, ſmooth, and well-rooted, are only to be choſen. At every thirty feet there ſhould be planted with the ſets a young oak, aſh, or ſome other ſuch tree, to grow up along with the hedge. When a complete row of the ſets is thus laid, cover them with a layer of fine mould, and lay over that

another layer of the turf; and upon this a third layer of mould, ſo deep, that its ſurface may be a foot above the row of ſets: on this bed place another row of the like ſets at the ſame diſtances, but placed between the others; cover this as the other, and then make up the bank with the earth dug out of the bottom of the ditch, and on its top ſet the dry, or dead hedge; this will ſhade the under plantation, and will be a defence till the ſets are grown up into a live hedge. The ſtakes for the dead hedge are to be driven into the bank ſo low as to reach the firm ground, and are to be placed at two feet and a half diſtance from one another.

Oak-ſtakes are the beſt for this purpoſe, and ſallow and black thorn are eſteemed next to theſe. The ſmall buſhes cut from them muſt be laid below, but not too thick, that they may ſhade the young plantation without ſmothering it, and defend its young ſhoots from the biting of cattle: the long buſhes are to be laid at top to bind in the ſtakes by interweaving them. To add a farther ſtrength to the hedge, it may be eddered, as the farmers call it: this is binding the tops of the ſtakes with ſome ſmall long poles, or ſticks on each ſide. When this is all done, the ſtakes ſhould be new drove a little, becauſe the making the hedge, and the eddering it, are apt to looſen them a little.

The young plants muſt be conſtantly weeded, and great care muſt be taken to preſerve them from the bitings of cattle, eſpecially of ſheep. If they have been cropped, or are not found to grow well, it is a good cuſtom among the farmers to cut them down to the ground, or within an inch of it, for after this they uſually ſend out new roots, and ſhoot very vigorouſly. *Mortimer's Huſbandry.*

SETACEUS *Vermis*, in natural hiſtory, a name given by Dr. Liſter to that long and ſlender water-worm, which ſo much reſembles a horſe-hair, that it has been ſuppoſed by the vulgar to be an animated hair of that creature.

SETHIANS, in eccleſiaſtical hiſtory, chriſtian heretics, who appeared in Egypt during the ſecond century. They paid divine honours to Seth, whom they conſidered as the Meſſiah, but pretended that he was made by a third divinity, and ſubſtituted in the room of the two families of Abel and Cain, which had been deſtroyed by the deluge. Theſe heretics continued in Egypt above two centuries, and, as they did not conſider debauchery as a crime, had many followers.

SETON, in ſurgery, a wound made generally in the hind part of the neck, and kept in a ſtate of ſuppuration by means of a ſmall ſkain of ſilk, cotton, or horſe-hair, paſſed through the ſkin by means of a needle or probe. It is of uſe to divert a defluxion of humours from the eyes.

SETTER, among farmers, implies a wound made in the dew-lap of an ox or cow, and a tent made of the root helleboraſter inſerted into it, whereby the wound is kept in a conſtant ſtate of digeſtion, and the humours find a vent.

SETTEE, a ſmall ſhip uſed principally by the Italians and Greeks in the Mediterranean. It is equipped with two maſts, which are furniſhed with lateen ſails. See the article LATEEN.

SETTING, in navigation, the act of marking the bearings of any diſtant object by the compaſs.

SETTING, in aſtronomy, implies the ſinking of a heavenly body below the horizon.

SETTING, among ſportſmen, implies a method of taking partridges by means of a dog properly trained for that purpoſe.

The ſetting-dog generally uſed is a long land-ſpaniel, taught by nature to hunt partridges more than any other game, and in his untaught ſtate running over the fields in ſearch of them; but being taught, the creature is under ſuch excellent command, that he will, in the midſt of his higheſt career, attend the leaſt hem from his maſter, and ſtand ſtill to look in his face and to take his orders by the ſlighteſt ſignals; and when he is ſo near his game that it is almoſt in his mouth, he will ſtand ſtock-ſtill, or lye down on his belly, till his maſter arrives, and he receives his directions. The ſetting-dog being taken to the haunt of the partridges, is to be caſt off, and ſent to range; but he muſt be made to keep near the ſportſman, and not to run wildly on, but to beat all the ground regularly. If in the dog's ranging he ſtops on a ſudden, the ſportſman is to make up to him, and as there is certainly game before him, he muſt be ordered to advance; if he refuſes this, and looks back and ſhakes his tail, it is a ſignal that they are cloſe before him, and the ſportſman is then to take a circumference, and look carefully before the dog's noſe, to ſee where they are, and how they lie; then going up and ſtaking down one end of the net, he is to command the dog to lie ſtill, and to draw the net gently over the birds, then making in with a noiſe, he is to ſpring them, and they will be entangled and taken, as they riſe.

SETTLING, in navigation, the act of lowering any object by the increaſe of the diſtance from it.

SEVENTH, in muſic, an interval, of which there are four kinds.

The firſt is called the diminiſhed or defective ſeventh, and conſiſts of three tones and three greater ſemi-tones.

The ſecond is compoſed diatonically of ſeven degrees and ſix intervals, of which four are tones, and the reſt greater ſemi-tones; and, chromatically, of ten ſemi-tones, ſix whereof are greater and four leſſer.

The third is compoſed diatonically like the former, of ſeven degrees and ſix intervals, ſix whereof are full tones, and the ſeventh a greater ſemi-tone; ſo that only one ſemi-tone is wanting to complete the octave; and, chromatically, of eleven ſemi-tones, ſix whereof are greater, and ſix leſſer.

The fourth, called the redundant ſeventh, is compoſed of five tones, a greater ſemi-tone and a leſſer; ſo that it wants only the difference between the greater and leſſer ſemi-tone, to render it equal to the octave.

In thorough baſes, the ſeventh is marked by a figure of 7, but if it be accidentally flat, by $b7$, or $7b$; if ſharp, $\sharp 7$, or $7\sharp$.

SEVERANCE, in law, the ſeparating of two parties joined in one writ.

SEWER, a drain, conduit, or conveyance, for carrying off water, ſuillage, &c. from a houſe, ſtreet, field, or the like.

SEWER, in the houſhold, implies an officer who comes in before the meat of a king or nobleman, to place it properly on the table.

SEWED, in the ſea-language, the ſtate of a ſhip when the water has ebbed from her as ſhe lies on the ground.

SEX, ſomething in the body which diſtinguiſhes the male from the female.

SEXES *of flowers*, thoſe parts of flowers which perform the ſame offices in the vegetable world, that the ſimilar parts of animal bodies perform in that department of nature.

"It is in the flowers of vegetables only, ſays the learned Dr. Watſon, that the parts ſubſervient to generation are produced. Simple flowers (I uſe the term in oppoſition to the compound flowers of the botaniſts) are either male, female, or hermaphrodite. By male flowers I would be underſtood to mean thoſe which are poſſeſſed only of thoſe organs of generation, analogous to the male parts of animals; and theſe are what former botaniſts have denominated ſtamina and apices, but are named more properly by Linnæus ſince, filamentum and anthera. The female flower is only endowed with parts like thoſe which perform the office of generation in females; and theſe are the piſtillum and its appurtenances, which, by Linnæus, with his accuſtomed accuracy, are divided into three parts, viz. the germen, ſtylus, and ſtigma. The hermaphrodite flower, which conſtitutes the great bulk of the vegetable creation, is poſſeſſed of all theſe parts in itſelf, and is itſelf thereby capable of propagating its ſpecies without any foreign aſſiſtance; which, by many inconteſtable experiments, it has been found, neither the male nor female flower ſimply, is able to do.

"Much the greater part of plants, as I have juſt hinted, have hermaphrodite flowers; but there are ſome, which have both the male and female flowers growing from the ſame root. Such are maize, or Indian corn, nettles, box, elm, birch, oak, walnut, beech, hazel, hornbeam, the plane-tree, pine, fir, cypreſs, cedar, the

larch-tree, melons, cucumbers, gourds, and ſeveral others. In many of theſe, though the male and female flowers are at conſiderable diſtances, the farina fœcundans, which Providence, on account of its being liable to be ſpoiled by rain, or diſſipated by winds, has provided in great abundance, is conveyed to the female by means of the atmoſphere. In this claſs of vegetables, the produce of the farina fœcundans is much greater than in others, becauſe the produce is much more precarious, than in thoſe plants which have hermaphrodite flowers; as the impregnation of the latter may be performed within their own calyx; whereas the former muſt neceſſarily commit their farina to the circumambient air. It is for this reaſon, that if during the time of the flowering of thoſe plants, the weather be either wet or ſtormy, their produce of fruit will be very inconſiderable, from the ſpoiling or diſſipation of the male farina. Thus, independent of froſts, the fruit of the nut and filberd-tree, will be moſt numerous in thoſe years, in which the months of January and February are leaſt ſtormy and wet; as at that time their flowers are produced. For the ſame reaſon a ſtormy or wet May deſtroys the cheſnuts; and the ſame weather in July prodigiouſly leſſens the crops of maize or Indian corn, as its ſpikes of male flowers ſtand lofty, and at a conſiderable diſtance from the female. In the ſame manner a judgment may be formed of the reſt of theſe plants.

"Some of the more ſkilful modern gardeners put in practice, with regard to melons and cucumbers, the very method mentioned by Theophraſtus two thouſand years ago, in regard to the palm-tree. As theſe plants, early in the ſeaſon, are, in this climate, confined to frames and glaſſes, the air in which they grow, is more ſtagnant than the open air, whereby the diſtribution of the farina fœcundans, ſo neceſſary towards the production of the fruit for the propagation of the ſpecies, is much hindered; to obviate which, they collect male flowers, when fully blown, and preſenting them to the female ones, by a ſtroke of the finger they ſcatter the farina fœcundans therein, and this prevents the fruit from falling off immaturely.

"Beſides the vegetables abovementioned, which bear both male and female flowers on the ſame root, there are others which produce thoſe neceſſary organs upon different roots. In the number of thoſe are the palm-tree, hops, the willow-tree, miſletoe, ſpinach, hemp, poplar, French and dog's mercury, the yew-tree, juniper, and ſeveral others. Among theſe the valiſneria of Linnæus, as to the manner in which its male flower impregnates the female, is one of the moſt ſingular prodigies in nature. The manner of this operation is figured by Micheli, in his Nova Plantarum Genera, and deſcribed by Linnæus, in the Hortus Cliffortianus. As that elaborate and expenſive work is in very few hands, in ſuch only as owe it to the munificence of Mr. Clifford of Amſterdam, of which number I with pleaſure acknowledge myſelf one, I will here lay before you a ſhort account thereof:

"The valiſneria grows in rivulets, ditches, and ponds, in many parts of Europe. The male plant, which is continually covered with water, has a ſhort ſtalk, upon the top of which its flowers are produced. As this top never reaches the ſurface of the water, the flowers are thrown off from it, and come unopened to the ſurface of the water; where, as ſoon as they arrive, by the action of the air, they expand themſelves, and ſwim round the female flowers, which are blown at the ſame time.

"Theſe laſt have a long ſpiral foot-ſtalk, by which they attain the ſurface of the water, and, remaining there in flower a few days, are impregnated by the male flowers detached from the ſtalk at the bottom. This operation ſeems to be thus directed, as the farina fœcundans could not exert its effects in ſo denſe a medium as water; and we find, that even the hermaphrodite flowers of water-plants, ſuch as thoſe of potamogiton, ranunculus aquaticus, hottonia, and nymphæa, theſe, I ſay, never expand themſelves, until they reach the ſurface of the water.

"But to return: it was not poſſible for me, without premiſing theſe things, to make evident what I intended, in relation to the ſafely denominating the ſexes of plants; as it is to this laſt claſs that the wrong application has been made by botanical writers. This error ſeems to have been firſt introduced ſo early as by Dioſcorides, and has been continued through a great variety of writers even to our own time. It is moſt certain, that thoſe plants which produce the ſeed, ought to be conſidered as females; but it happens that, in the French and dog's mercury, the ſeeds are produced in the female plants by pairs; and theſe are contained in a capſule, which was thought to reſemble the ſcrotum of animals; and from this teſticulated appearance they called theſe plants males, and the others females.

"Dioſcorides, when treating of mercurialis, or what we here call French mercury, ſays, that 'the ſeed of the 'female is produced in bunches, and is copious; that of 'the male grows near the leaves; that it is ſmall and 'round, and is diſpoſed in pairs like teſticles.' Dodonæus, Lobel, Delechamp, John and Caſpar Bauhin, Morriſon, Tournefort, and Boerhaave, in their ſeveral works, have in this followed Dioſcorides, and have denominated the ſeed-bearing plant of this kind, the male; and the other, the female. Fuchſius and John Bauhin likewiſe call the cynocrambe or dog's mercury, which bears fruit, the male; and the ſpiked one with male flowers only, the female. This miſtake is obſervable in hemp, hops, and ſpinach.

"We obſerve, that the operations of nature are carried on moſt uſually by certain general laws, from which however ſhe ſometimes deviates. Thus almoſt all plants have either hermaphrodite flowers, or male and female flowers, growing from the ſame root, or male and female flowers from different roots: but there are a few of another claſs, which from the ſame root furniſh either male and hermaphrodite flowers, or female and hermaphrodite flowers. Of this kind are the mulberry-tree, the mura or plantain-tree, white hellebore, pellitory, arrach, the aſh tree, and a few others. But of this claſs the empetrum or berry-bearing heath is the moſt extraordinary; as of this are found ſome plants with male flowers only, others with both male and female flowers ſeparately, and ſtill others with hermaphrodite flowers." *Philoſ. Tranſ. Vol.* XLVII.

The late ingenious Dr. Alſton, king's botaniſt in Scotland, has endeavoured to overturn the whole doctrine of the ſexes of plants, by ſhewing that the farina fœcundans is not neceſſary to the production of fertile ſeeds. We ſhall add the following inſtances which he has brought to ſupport his doctrine.

"In the ſpring 1737, I tranſplanted, ſays he, three ſets of common ſpinage, long before it could be known, whether they were flowering or ſeed-bearing plants, from a little bed on which they were raiſed, into a place of the garden, full eighty yards diſtant, and almoſt directly ſouth; there being two haw-thorn, and three holly hedges, all pretty thick and tall, between them and their ſeed bed; and no other ſpinage in the garden, nor ſo near them by far: all the three proved fertile plants, and ripened plenty of ſeeds. I ſowed them, they grew, and proſpered as well as any ſpinage ſeed poſſibly could do. This, I own, made me, at firſt, call in queſtion the ſexes of plants, which I formerly too implicitly believed.

"The ſame year, a few plants of the common hemp, which I had raiſed for a ſpecimen from the ſeed, being accidentally deſtroyed when very young; and finding afterwards, about the end of June, a pretty ſtrong but late plant of hemp, growing in the incloſure to the eaſt of Holyrood houſe, commonly called the bowling green, by itſelf; I cauſed great care to be taken of it; there not being that year any hemp raiſed within a mile of it, that I could find. This plant grew luxuriantly; and, though bad weather in the autumn made me pluck it up a little too ſoon, yet I got about thirty good ſeeds from it, which the ſucceeding ſpring produced as thriving male and female plants as if the mother hemp had ſtood ſurrounded with males. And in the ſpring 1741, I carried two young ſeedling plants of the French mercury, long before there was any in flower, from the city phyſic garden, the only place where it was then to be found in this country, to the king's garden at the abbey, which are more than 700 yards diſtant from one another, with many high houſes,

trees,

trees, hedges, and part of a hill between them: and planted one of them in one incloſure, where it was ſhaded from the ſun the greateſt part of the day; and the other, in another, twenty-five yards diſtant, expoſed to the ſouth and weſt. Both plants ripened fertile ſeeds; and the laſt ſhed them ſo plentifully, that it proved a troubleſome weed for ſeveral years: though none of the ſpecies was to be found in that garden, for more than twenty years preceding.

"Hence, the duſt of the apices of theſe ſpecies of plants cannot, on any account, be called their genitura. And the ſame may be ſaid of the lupulus, according to Mr. Tournefort's obſervation; of the bryonia, as noticed by Mr. Miller; alſo of Mr. Geoffroy's maize.

"One year, obſerving two ſtrong tulips growing together, in an incloſure ſurrounded with a tall and thick quick-ſet haw-thorn hedge; I cut down two or three more tulips, which ſtood at ſome diſtance from them ſo as to leave none within that incloſure, ſave the two I mentioned: out of theſe, gently opening the petala, I plucked all the ſtamina with their apices ſtill intire. The conſequences of this too rude caſtration, were a conſiderable extravaſation of the juices, in the bottom of the flower, and a ſudden decay of the ovarium or fruit, which never increaſed, but turned yellow, ſhrunk, and withered. In order to diſcover whether this abortion was owing to the wounds, or to the want of the duſt of the apices; I ſuffered theſe two tulips to remain in the place where they were: and next ſeaſon, with the ſame precaution that no other tulips ſhould flower within the incloſure, I opened the petala, and took out carefully, not the ſtamina, only, but all the apices; which prevented any ſenſible bleeding of the parts. This more gentle caſtration they bore perfectly well: the ovarium ſuffered nothing, in either of them, but increaſed, and came to maturity, quite full of ſeeds." See the *Eſſays Phyſical and Literary, read before a Society in Edinburgh*, Vol. I. Page 205.

SEXAGENARY, ſomething relating to the number ſixty.

SEXAGENARY, or *Sexageſimal*, *Arithmetic*, implies a method of computation proceeding by ſixties; ſuch as is uſed in the diviſion of a degree into ſixty minutes, of a minute into ſixty ſeconds, of a ſecond into ſixty thirds, &c.

SEXAGESIMA, the ſecond Sunday before Lent, ſo called becauſe near ſixty days before Eaſter.

SEXAGESIMALS, or SEXAGESIMAL *Fractions*, are fractions whoſe denominators are in a ſexagecuple ratio; that is, a prime $= \frac{1}{60}$, a ſecond $= \frac{1}{3600}$, a third $\frac{1}{216000}$, &c.

SEXANGLE, in geometry, a figure containing ſix angles, and conſequently ſix ſides.

SEXTANS, a word uſed by the old Romans to ſignify the ſixth part of any weight, meaſure, &c.

SEXTANT, in geometry, ſignifies the ſixth part of a circle, or an arch containing 60 degrees.

SEXTANT is alſo the name of a mathematical inſtrument, whoſe limb contains ſixty degrees.

SEXTILE, an aſpect of the planets, when they are two ſigns or ſixty degrees diſtant from each other.

SEXTON, an officer in the reformed churches, whoſe office it is to take care of the veſſels, veſtments, &c. belonging to the church, and to attend the miniſter, church-wardens, &c. at their meetings.

SEXTUPLE, in muſic, implies a mixed ſort of triple time, which is beaten in double time.

SEXUALISTÆ, a term uſed by botanical authors, to ſignify thoſe writers who have eſtabliſhed the claſſes of plants upon the difference of the ſexes, and parts of fructification of plants; ſuch as Linnæus, and many others. See the article SEXES *of Flowers*.

SHAD, the name of a ſea-fiſh, of the herring kind, called alſo the mother of the herring, and by ſome authors clupea.

It is very common in many ſeas, and in ſome of our large rivers where the tide ebbs and flows. They run up theſe ſtreams in great numbers during the months of March and April, when they are very fat; in May they become lean, and then return again to the ſea.

SHADOW, in optics, a privation, or rather a diminution of light, by the interpoſition of ſome opaque body.

A ſhadow is of itſelf inviſible; and, therefore, when we ſay we ſee a ſhadow, we partly mean that we ſee bodies placed in the ſhadow, and illuminated by light reflected from collateral bodies; and, partly, that we ſee the confines of the light. See the article LIGHT.

If the opaque body that projects the ſhadow be perpendicular to the horizon, and the place it is projected on be horizontal, the ſhadow is called a right ſhadow; and ſuch are the ſhadows of men, trees, buildings, mountains, &c. But if the opaque body be placed parallel to the horizon, the ſhadow is called a verſed ſhadow; as the arms of a man ſtretched out, &c.

The Laws of the Projection of SHADOWS *from opaque Bodies.* 1. Every opaque body projects a ſhadow in the ſame direction with its rays; that is, towards the part oppoſite to the light. Hence, as either the luminary or the body changes place, the ſhadow likewiſe changes. 2. Every opaque body projects as many ſhadows as there are luminaries to enlighten it. 3. As the light of the luminary is more intenſe, the ſhadow is the deeper: hence the intenſity of the ſhadow is meaſured by the degrees of light that ſpace is deprived of. 4. If a luminous ſphere be equal to an opaque one it illuminates, the ſhadow, which this latter projects, will be a cylinder, and conſequently will be propagated ſtill equal to itſelf, to whatever diſtance the luminary is capable of acting; ſo that if it be cut in any place, the plane of the ſection will be a circle, equal to a great circle of the opaque ſphere. 5. If the luminous ſphere be greater than the opaque one, the ſhadow will be conical. If, therefore, the ſhadow be cut by a plane, parallel to the baſe, the plane of the ſection will be a circle; and that ſo much the leſs as it is a greater diſtance from the baſe. 6. If the luminous ſphere be leſs than an opaque one, the ſhadow will be a truncated cone; and, conſequently, grows ſtill wider and wider; and therefore, if cut by a plane, parallel to the ſection, that plane will be a circle, ſo much the greater as it is further from the baſe.

Of SHADOWS *from the Sun.* The ſun being vaſtly larger than the whole globe of the earth, muſt give all its ſhadows pointed, by reaſon it illumines more than half of them.

In conſequence of this demonſtration, we might conclude, that all the ſun's ſhadows muſt be leſs than the bodies that project them, and diminiſh more and more as they recede further and further. Now this would be true were there any relation between the body illuminated and the body illumining; but as all objects on the earth are ſo ſmall in compariſon of that ſtar, the diminution of their ſhadows is imperceptible to the eye, which ſees them always equal; i. e. either broader or narrower than the body that forms them: on this account all the ſhadows cauſed by the ſun are made in parallels.

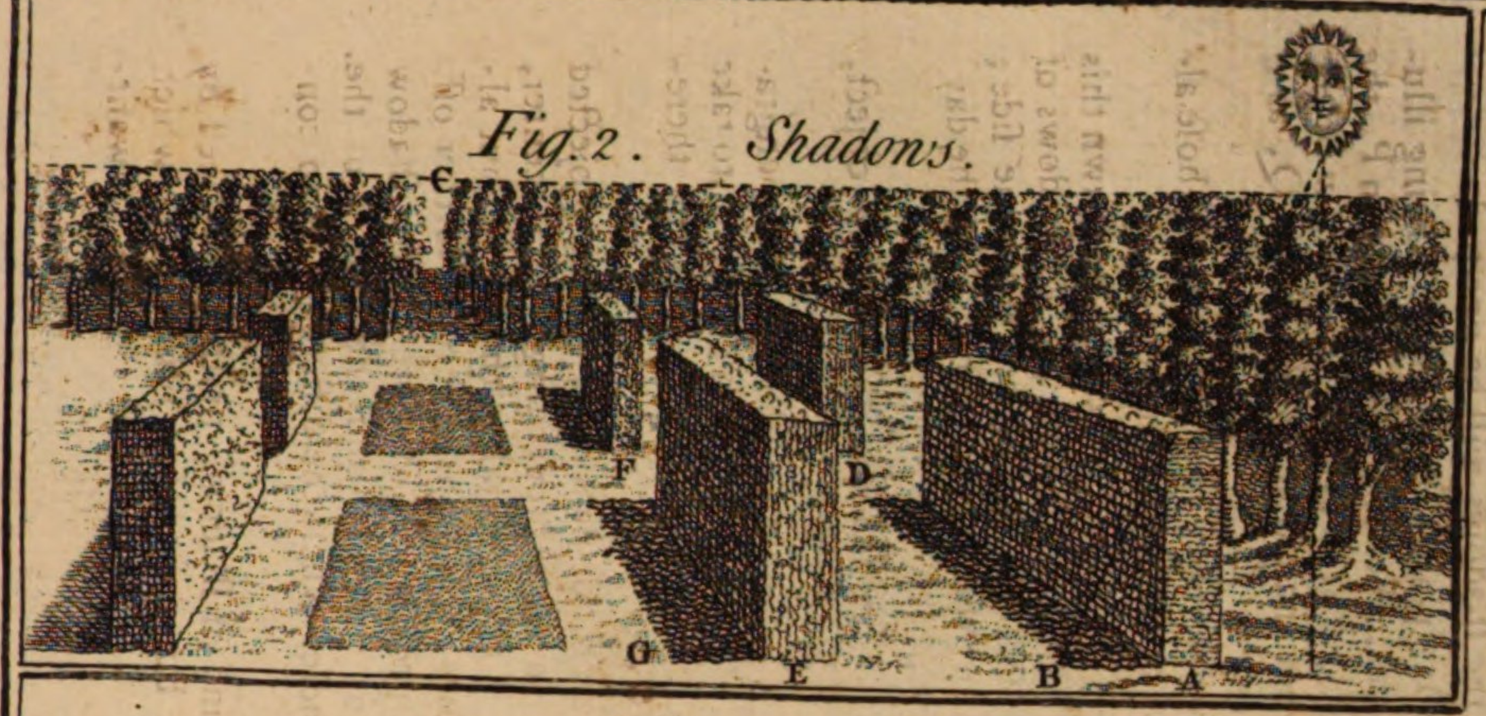
From the whole it appears, that to find the ſhadow of any body whatever oppoſed to the ſun, a line muſt be drawn from the top of the luminary perpendicular to the place where the foot of the luminary is to be taken: and through this place an occult line is to be drawn through one of the angles of the plan of the object, and another from the ſun to the ſame angle; and the interſection of the two lines will ſhew how far the ſhadow is to go: all the other lines muſt be drawn parallel thereto.

The ſhadows of the ſun are equal in objects of the ſame height, though at a diſtance from each other. See plate CXIV. *fig.* 2.

Experience teaches, that ſtiles, or elevations of the ſame height, removed to a diſtance from each other, do yet project equal ſhadows at the ſame time: for they are lengthening and ſhortening, in proportion as the ſun comes nearer, or recedes further off; one or other of which he is continually doing.

For this reaſon, when the ſhadow of an object is to be caſt any way, you muſt determine the place of the ſun, and the point underneath, to draw two occult lines from the ſame, for the extremity of the ſhadow; as here the paliſade A gives the extreme of its ſhadow in B: and if

Fig. 2. Shadons.



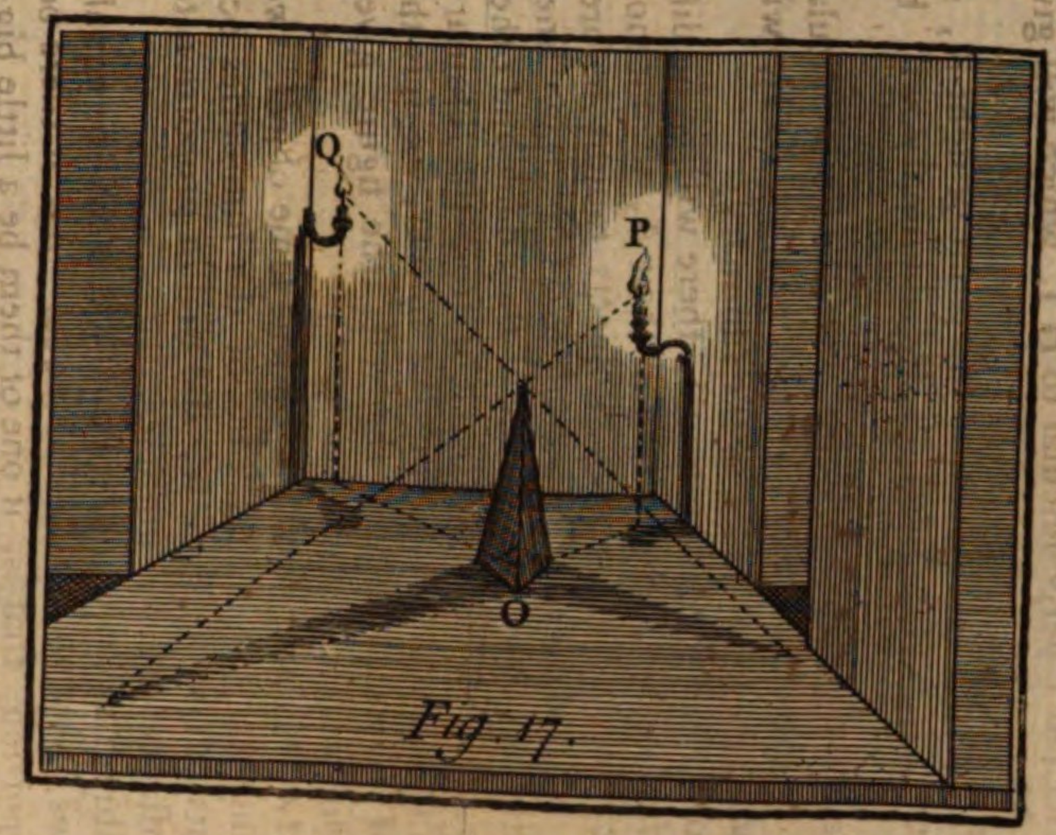


Fig. 17.

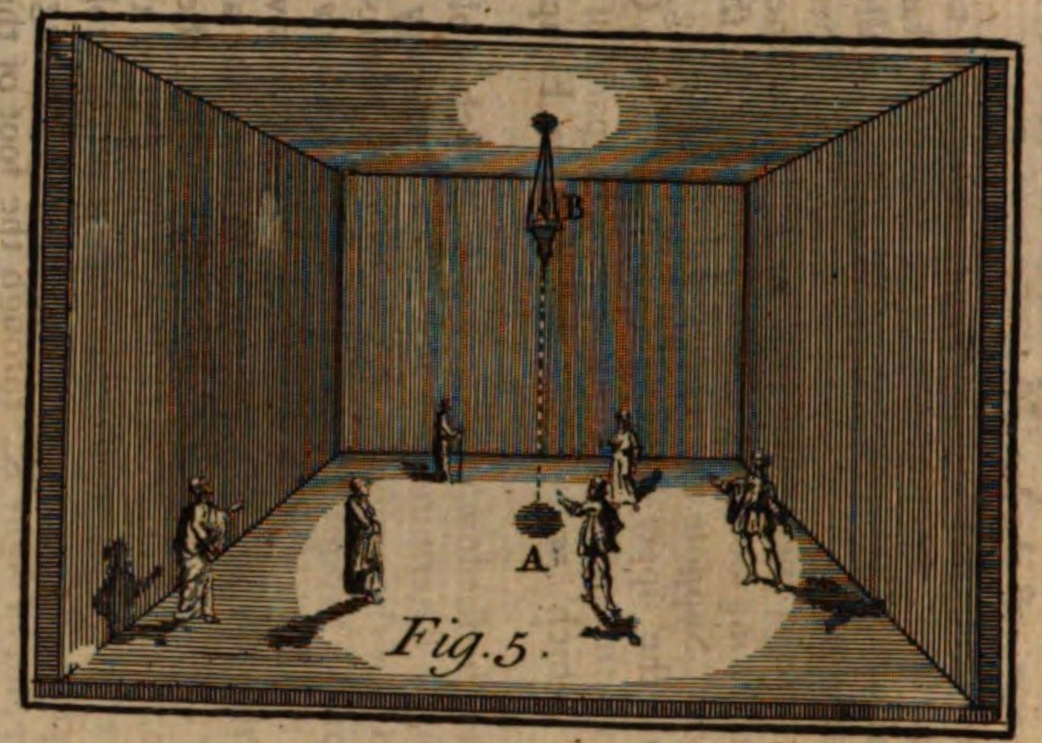


Fig. 5.

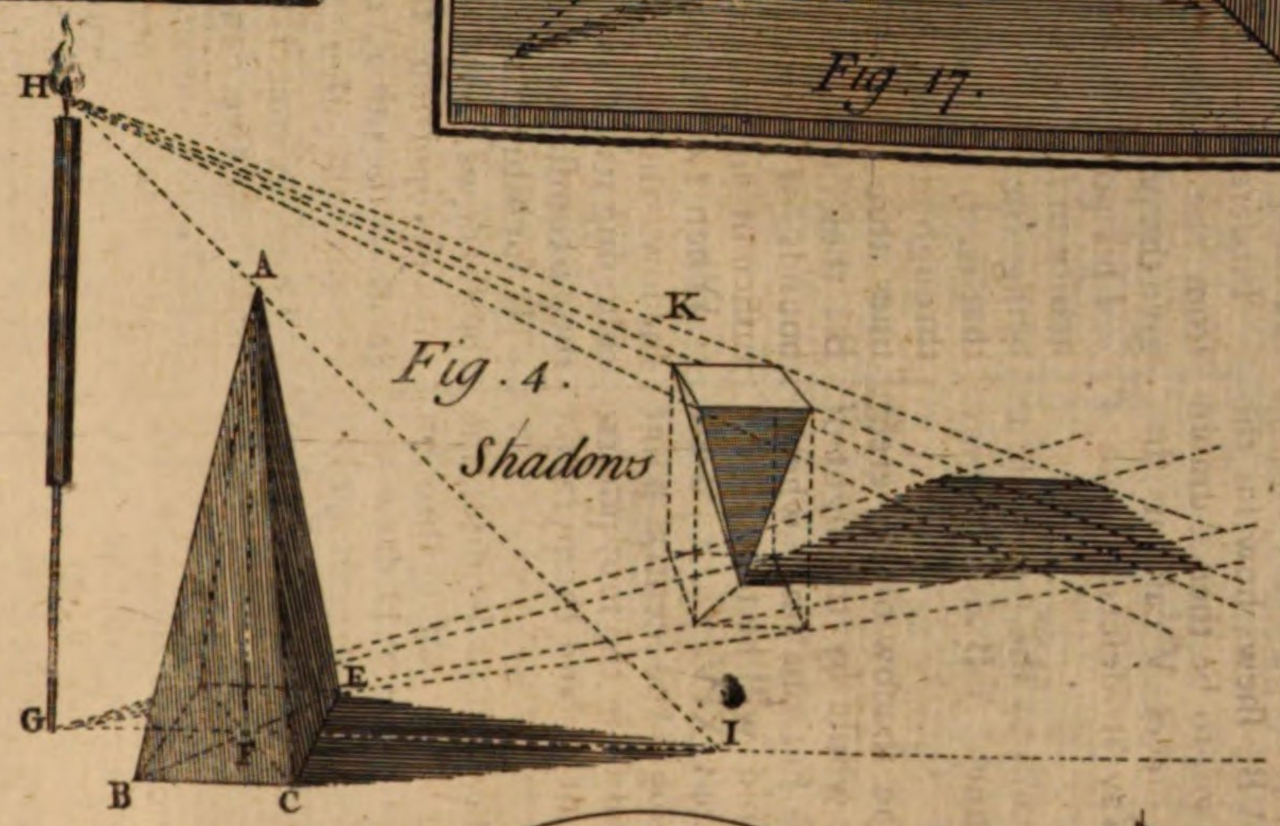


Fig. 4. Shadons

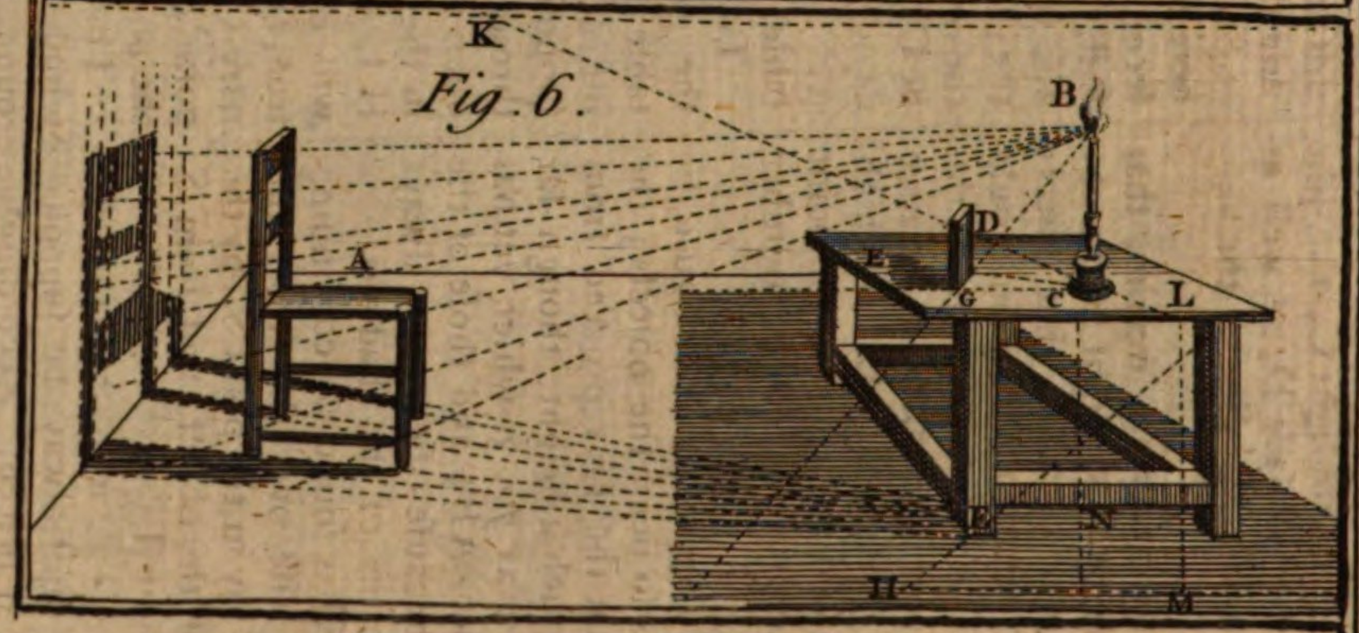


Fig. 6.

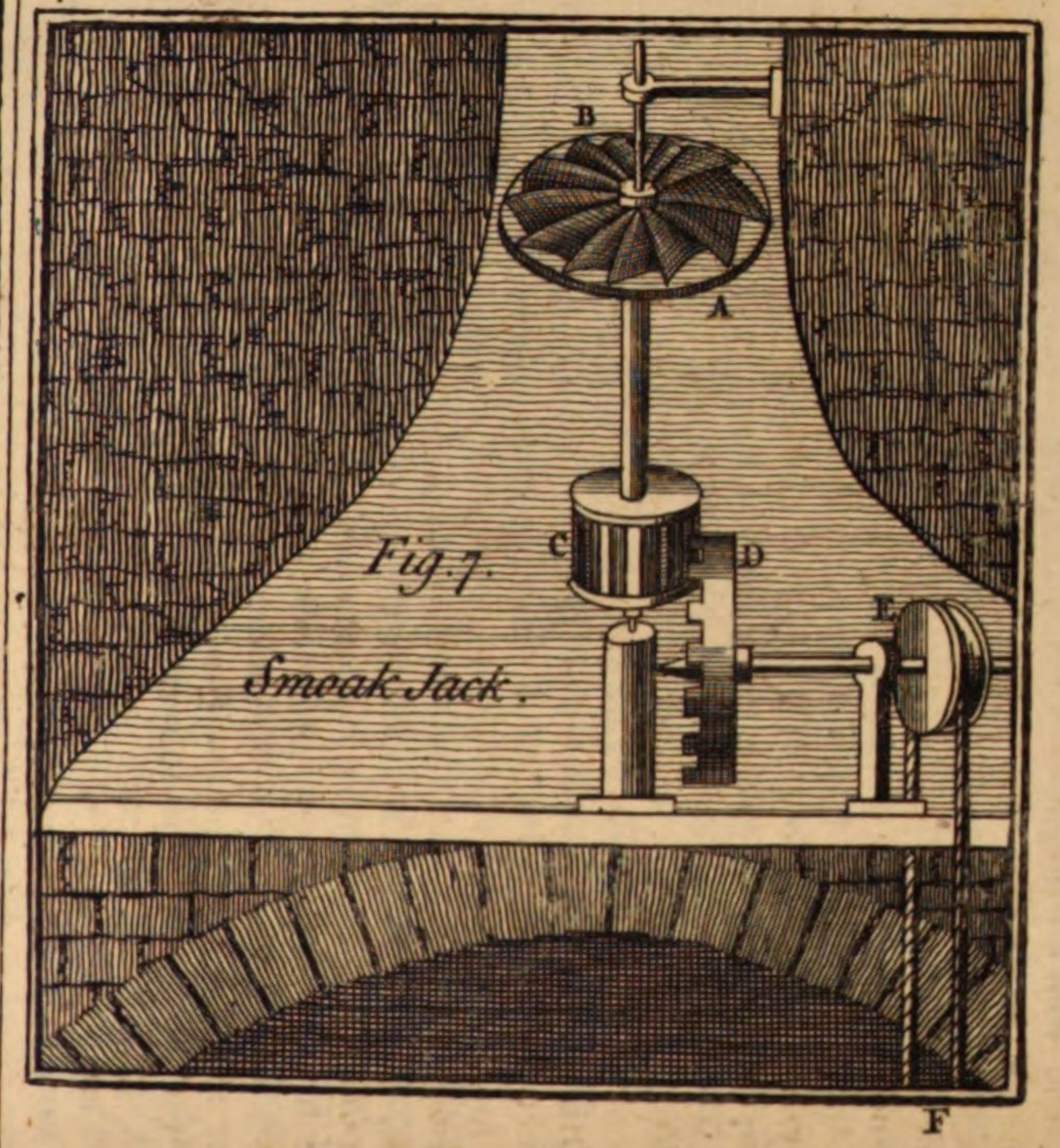


Fig. 7. Smoak Jack.

F

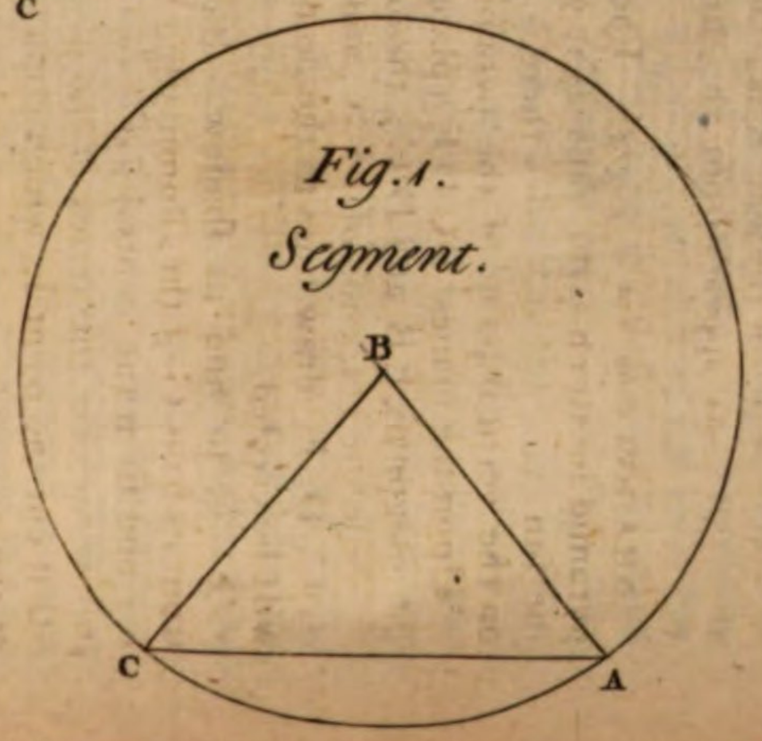


Fig. 1. Segment.

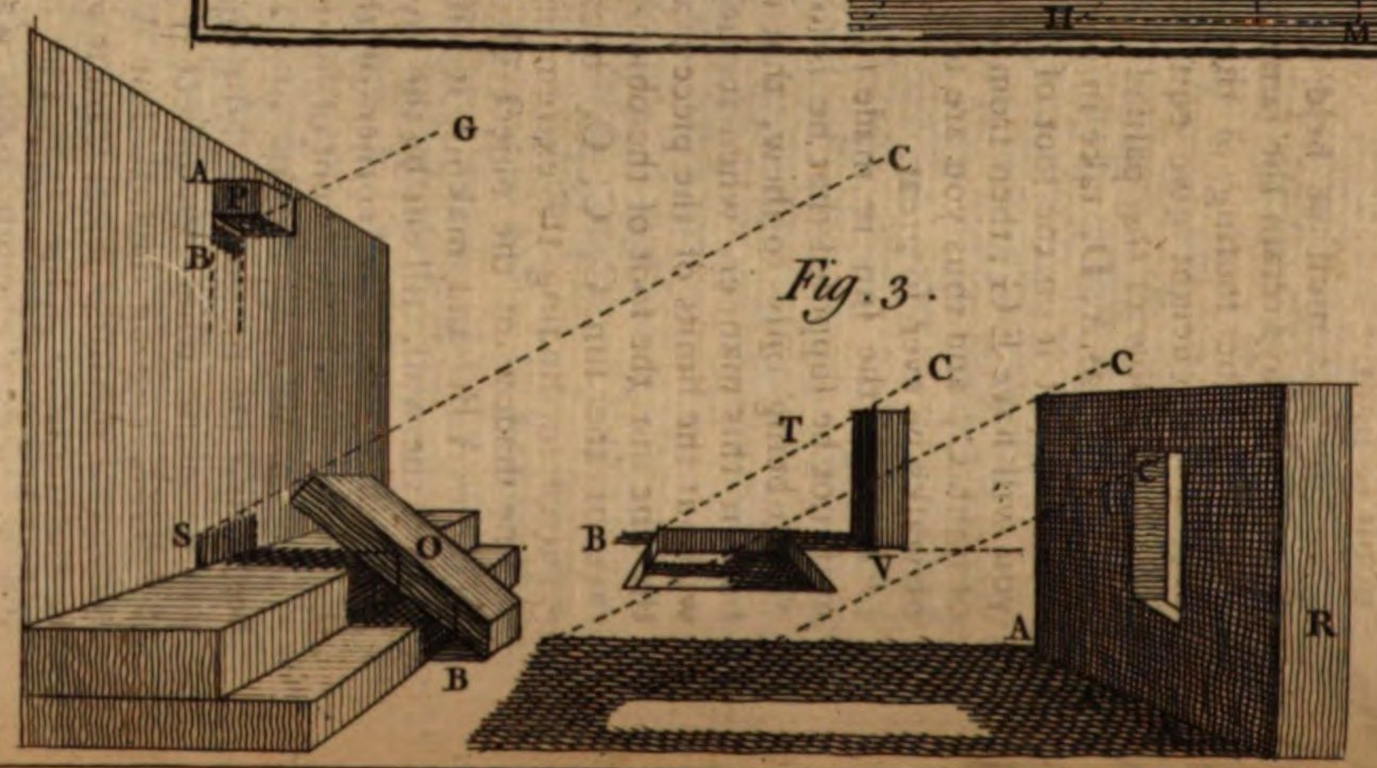


Fig. 3.

from this point B, you draw a point of ſight C, this line B C will be the ſhadow of the paliſade D, as well as that of A, and of all the reſt in the ſame line to the very point of ſight.

In effect, it muſt be held for a certain maxim, that ſhadows always retain the ſame point of ſight as the objects. On the footing of this obſervation, that objects of the ſame height give equal ſhadows; if you would give the ſhadow of the paliſades, E, F, which are of the ſame height as A, D, take in your compaſſes the diſtance A D, and ſet it on the foot of the paliſade E, by which you will have E G; then from G draw a line to the point of ſight C; and thus you are to proceed, let the number of walks be ever ſo great.

Though the ſun is made to appear in this figure, it muſt not be ſuppoſed that he is ſo near the objects; the deſign being only to ſhew, that the rays proceed from him in this manner, when at ſuch a height, though far without the limits of the piece; as *fig.* 3. which yet has the line for the foot of the object A B; and thoſe of the rays of the ſun C, C, C, becauſe theſe are always required for finding the extremities of the ſhadows.

The ſhadow of the object O is found by continuing the line A B, and making it riſe over the ſteps, and againſt the wall, till cut by the ray in the point S, by the rays paſſing over the corner of the object, and from S drawing a line to the point of ſight T.

To find the ſhadow of the object P, it muſt be remembered that the foot of the light muſt always be ſuppoſed on the plane where the object is placed. Accordingly, the ray C, cutting the little line A B, ſhews how far the ſhadow of the little object P muſt go, to be thence drawn to the point of ſight T. The object V caſts its ſhadow all along, though in its way it deſcends into a ditch.

The ſhadow of the wall R is found by the ſame rule as the reſt; as appears from the lines A B and the ray C.

SHADOWS *by Torch-Light.* The ſhadow of an erect pyramid by torch-light falls as it would by the light of the ſun; and in both caſes there is but one line, whereon the vertical point of the pyramid will be found.

Upon the planes B C D E (plate CXIV. *fig.* 4.) draw the diagonals E B and D C; through the central point F, raiſe the perpendicular F A; and from the four points, B, C, D, E, draw lines to the point A, and the pyramid will be erected.

Then, to find its ſhadow, draw an indefinite line from its baſis G of the illuminating body, paſſing through F; and from the central flame of the torch H draw another line over the vertex of the pyramid in the line G F, till it cut the point I, which point will limit the ſhadow of the pyramid.

Laſtly, draw a line from C to I, and another from E to I, and the triangle C I E will be the ſhadow of the pyramid. To gain the ſhadow of an inverted pyramid draw perpendicular lines from the angular points of its baſe, and form the ſubjacent plane, by means thereof, after the manner directed for the ſun.

And from all the angles of this plane draw lines to the baſe of the torch G; then from H, the central point of the flame, draw other lines touching all the angles of the baſe of the inverted pyramid, and dividing thoſe of the plane, whereby the ſhadow will be defined.

Shadows from the ſun are caſt all the ſame way, and have the ſame diſpoſition; it being impoſſible that the ſun ſhould occaſion one ſhadow towards the eaſt, and another towards the weſt, at the ſame time.

It is true, in different times of the day, it makes this difference; but never in one and the ſame hour.

But the torch, candle, and lamp, have always this effect; for in what place ſoever one of theſe luminaries be found, provided there be a number of objects about them, the ſhadows will be caſt various ways; ſome to the eaſt, ſome to the weſt, ſome to the north, and others to the ſouth, according to the ſituation of the objects around the luminary: the foot of which, here repreſented by A, (*fig.* 5.) ſerves as a common center, from which they all proceed: and the flame, here repreſented by B, ſhews where they are to terminate, though at different diſtances; as the neareſt produce the ſhorteſt ſhadows, and the remoteſt the longeſt.

SHADOWS *on ſeveral Parallel Planes.* The firſt plane here is the floor, whereon the chair A (*fig.* 6.) ſtands; the ſecond plane is the upper part of the table, parallel to the firſt, and may be either above or below it. There might alſo be more of theſe planes, wherein to find the foot of the illuminating body, in order to come at the ſhadow of the object. Suppoſe the foot of the illuminating body to be C, and the upper flame B; from the points C and B draw lines through the upper and under parts of the object D, which will give the ſhadow E upon the table.

To find the ſhadow of the chair A, which is placed on the ground, determine the foot of the luminary on the table in C on the ground: this is eaſy by the following inſtructions. From the point of diſtance, which is here ſuppoſed to be without the limits of the paper, draw a line through the foot of the table F; then from the angle G upon the table let fall a perpendicular, cutting the line F in the point H, and from H draw a parallel to the baſe H I, which is equal to the upper part of the table, and will direct to the thing required. For drawing a line from the point of ſight K, through the foot of the luminary C, to the extremity of the table L; from the ſame point L, let fall a perpendicular to H I, which will give the point M.

Then from M draw a line to the point of ſight K, in which line M K the foot of the luminary will be found.

To determine the preciſe point, let fall a perpendicular from the point C, which, cutting the line M H, will give the point N for the foot of the luminary.

This point N being thus found, there will be no difficulty in finding the ſhadow of the chair A, the method being the ſame as for the other objects taught before; that is, from the foot of the luminary N draw lines through all the angles of the plane of the chair, and other lines thro' the upper part of the chair from the luminary B; theſe latter, by interſecting the former, expreſs the bounds of the ſhadow. For the reſt, the figure gives ſufficient directions.

When two luminaries ſhine on the ſame object, two ſhadows muſt be produced; each of the luminaries occaſioning its reſpective ſhadow, and that in proportion to the circumſtances of the luminary.

If ſuch luminaries, when at equal diſtances, be equal, the ſhadows themſelves muſt be equal: but if there be any diſproportion, that is, if one of them be a little bigger than the other, or one of them a little nearer the object than the other, the ſhadows will be unequal.

Thus the object O, (plate CXIV. *fig.* 7.) being illuminated by two candles, the one near at hand in P, the other farther off in Q, it is evident the ſhadow of the candle P will be deeper than that of the candle Q, as is expreſſed in the figure.

The rules for ſuch ſhadows are the ſame with thoſe already given, both for the ſun and the torch.

From what has been obſerved before may be drawn this concluſion, that the ſame object may project ſhadows of divers forms, though ſtill illumined on the ſame ſide; the ſun giving one form, the torch another, and the daylight no preciſe form at all.

The ſun always makes its ſhadow equal to the object, that is, projects it parallelwiſe.

It is certainly of conſequence to all painters, engravers, &c. to obſerve theſe rules preciſely, and not to take the rules for candles, lamps, and the like, in lieu thereof, as is too frequently done.

The ſhadow of a torch, or flambeau, is not projected in parallel lines, but in rays proceeding from a center, whence the ſhadow is never equal to the body, but always bigger, and grows more ſo as it recedes farther off. It appears therefore a groſs abuſe to repreſent the ſhadow of a torch like that of the ſun, and the ſhadow of the ſun like that of a candle, when the difference is ſo conſiderable.

There is a third kind of ſhadow, neither produced by the ſun nor a torch; but only a fine ſunny day, which

wanting ſtrength to finiſh and define its form, occaſions a dimneſs near the object. Now for this there is no certain rule, but every body conducts it at diſcretion.

All theſe ſhadows, whether of the ſun, torch, or daylight, muſt appear darker than the parts of objects not illuminated, and that part of the ſhadow moſt remote from the object muſt be darker than that nearer it. See CLARO-ORSCURO

SHAFT *of a Column*, in architecture, is the body of it, or the part contained between the capital and the baſe.

SHAFT *of a Mine*, the entrance or paſſage into it.

SHAGREEN, or CHAGREEN, a kind of grained leather imported from Conſtantinople, and the coaſt of Barbary, where it is ſaid to be prepared from the ſkin of the hound fiſh, and is much uſed in covering caſes for inſtruments, &c.

SHAMBLES, in mining, a term uſed to expreſs a ſort of niches, or landing-places, left at certain diſtances in the audits of mines.

The method of digging the tin mines in Devonſhire, and ſome parts of Cornwall, is this: they ſink their way in ſuch a breadth, as is ſufficient for them to ſtand and work, and at every fathom they leave a ſquare place vacant, to which the ore is to be thrown up with ſhovels, as it is dug. This they do from caſt to caſt; that is, as far as a man can conveniently throw up the ore with his ſhovel. Thus the ore, as it is dug by the beelmen, is thrown up by the ſhovellers, who follow them from ſhamble to ſhamble, till it comes to the top of the mine. This, however, is but an inconvenient way, and the uſe of theſe ſhambles is generally ſupplied by a winder at the opening of the mine, which manages two buckets, the one of which is ſent down empty, while the other is ſent up full; and one man employed below to load, and another above to empty. *Phil. Tranſ. Num.* 69.

SHAMMY, or CHAMOIS *Leather*, a kind of leather dreſſed either in oil or tanned, and greatly eſteemed for its ſoftneſs, pliancy, and being capable of bearing ſoap without injury.

The true ſhammy is made from the ſkin of the chamois-goat, but is counterfeited with that of the common goat, kid, and even ſheep-ſkins. The manner of preparing it is as follows.

The ſkins being waſhed, drained, and ſmeared over with quick-lime on the fleſhy ſide, are folded in two, length-wiſe, the wool outwards, and laid on heaps, and ſo left to ferment eight days: or, if they had been left to dry after flaying, fifteen days.

Then they are waſhed out, drained, and half dried; laid on a wooden leg, or horſe, the wool ſtripped off with a round ſtaff for the purpoſe, and laid in a weak pit, the lime whereof had been uſed before, and had loſt the greateſt part of its force.

After twenty four hours they are taken out, and left to drain twenty-four more; then put in another ſtronger pit. This done, they are taken out, drained, and put in again, by turns; which begins to diſpoſe them to take oil: and this practice they continue for ſix weeks in ſummer, or three months in winter; at the end whereof they are waſhed out, laid on the wooden leg, and the ſurface of the ſkin on the wool-ſide peeled off, to render them the ſofter: then, made into parcels, ſteeped a night in the river, in winter more; ſtretched, ſix or ſeven over one another, on the wooden leg; and the knife paſſed ſtrongly on the fleſh-ſide, to take off any thing ſuperfluous, and render the ſkin ſmooth.

Then they are ſtretched, as before, in the river; and the ſame operation repeated on the wool-ſide; then thrown into a tub of water with bran in it, which is brewed among the ſkins till the greateſt part ſtick to them; and then ſeparated into diſtinct tubs, till they ſwell, and riſe of themſelves above the water.

By this means, the remains of the lines are cleared out: they are then wrung out, hung up to dry on ropes, and ſent to the mill, with the quantity of oil neceſſary to ſcour them: the beſt oil is that of ſtock-fiſh.

Here, they are firſt thrown in bundles into the river for twelve hours, then laid in the mill-trough and fulled without oil till they be well ſoftened; then oiled with the hand, one by one, and thus formed into parcels of four ſkins each, which are milled and dried on cords a ſecond time, then a third: then oiled again and dried.

This proceſs is repeated as often as neceſſity requires: when done, if there be any moiſture remaining, they are dried in a ſtove, and made up into parcels wrapped up in wool: after ſome time they are opened to the air, but wrapped up again as before, till ſuch time as the oil ſeems to have loſt all its force, which it ordinarily does in twenty-four hours.

The ſkins are then returned from the mill to the chamoiſer, to be ſcoured; which is done by putting them in a lixivium of wood-aſhes, working and beating them in it with poles, and leaving them to ſteep till the lye have had its effect; then they are wrung out, ſteeped in another lixivium, wrung again, and this repeated till all the greaſe and oil be purged out. When this is done, they are half dried, and paſſed over a ſharp-edged iron inſtrument, placed perpendicular in a block, which opens, ſoftens, and makes them gentle: laſtly, they are thoroughly dried, and paſſed over the ſame inſtrument again, which finiſhes the preparation, and leaves them in form of ſhammy.

Kid and goat ſkins are ſhamoiſed in the ſame manner as thoſe of ſheep; excepting that the hair is taken off, without the uſe of any lime; and that, when brought from the mill, they undergo a particular preparation, called ramalling; the moſt delicate and difficult of all the others.

It conſiſts in this, that as ſoon as brought from the mill, they are ſteeped in a proper lixivium: taken out, ſtretched on a round wooden leg, and the hair ſcraped off with the knife; this makes them ſmooth, and in working caſts a fine nap. The difficulty wholly conſiſts in the ſcraping them evenly.

Explanation of Plate CXV. repreſenting a mill for fulling the ſhammy.

Fig. 1. repreſents the mill drawn in perſpective.

A B, is a vertical arbor carrying a horizontal wheel of forty-eight cogs. That vertical arbor is the center of motion, and is turned by the lever G, to which is faſtened a ſpring-tree bar, for a horſe.

The above wheel turns the lantern C, furniſhed with twenty rounds, and fixed upon the horizontal arbor CD, and elevated ſufficiently for the horſe to paſs under it without the leaſt obſtruction.

At the extremity D of the above arbor is fixed a ſpur-wheel, furniſhed with forty two cogs, and which turns the lantern E, furniſhed with twenty rounds. This lantern is fixed on the horizontal arbor E F. On this arbor the cranks 5, 6, &c. which raiſe the beetles or ſtampers 1, 2, 3, 4, &c. are fixed.

Theſe beetles are ſupported in a ſtrong cage of carpentry, as repreſented in the figure, and are ſuſpended when not at work by the rolls *a*, *b*, on which the cords paſſing over the pullies 8, 9, are wound, and the other end of them faſtened to rings or ſtaples fixed in the heads of the beetles.

The faces of theſe beetles are indented, and fall upon the ſkins placed in the troughs.

Fig. 2. is a plan of the mill, and exhibits more conſpicuouſly the cranks which raiſe the beetles, 6, 7, 10, 5, 11, 12, 13.

The rollers *a*, *b*, are alſo here plainly repreſented. The other letters in this figure refer to the ſame parts, as the ſame letters in *fig.* 1.

SHANK, in the manege, ſignifies that part of a horſe's fore-leg, which lies between the knee and the fetlock.

SHANKER, in medicine, a malignant ulcer, uſually occaſioned by the venereal diſeaſe.

Cockburn ſays any ſhanker may be cured with an ointment compounded of quickſilver and turpentine, without any further trouble, and Heiſter recommends the ſame method of practice.

SHARE *of a Plough*, that part which cuts the ground, the extremity forward being covered with a ſharp-pointed iron called the point of the ſhare; and the end of the wood behind the tail of the ſhare.

The length of the whole ſhare, from point to tail, according to Tull, ſhould be three feet nine inches; at the top of the iron it has an upright piece called the fin, and, near

PLATE CXV.

Facing Shammy.

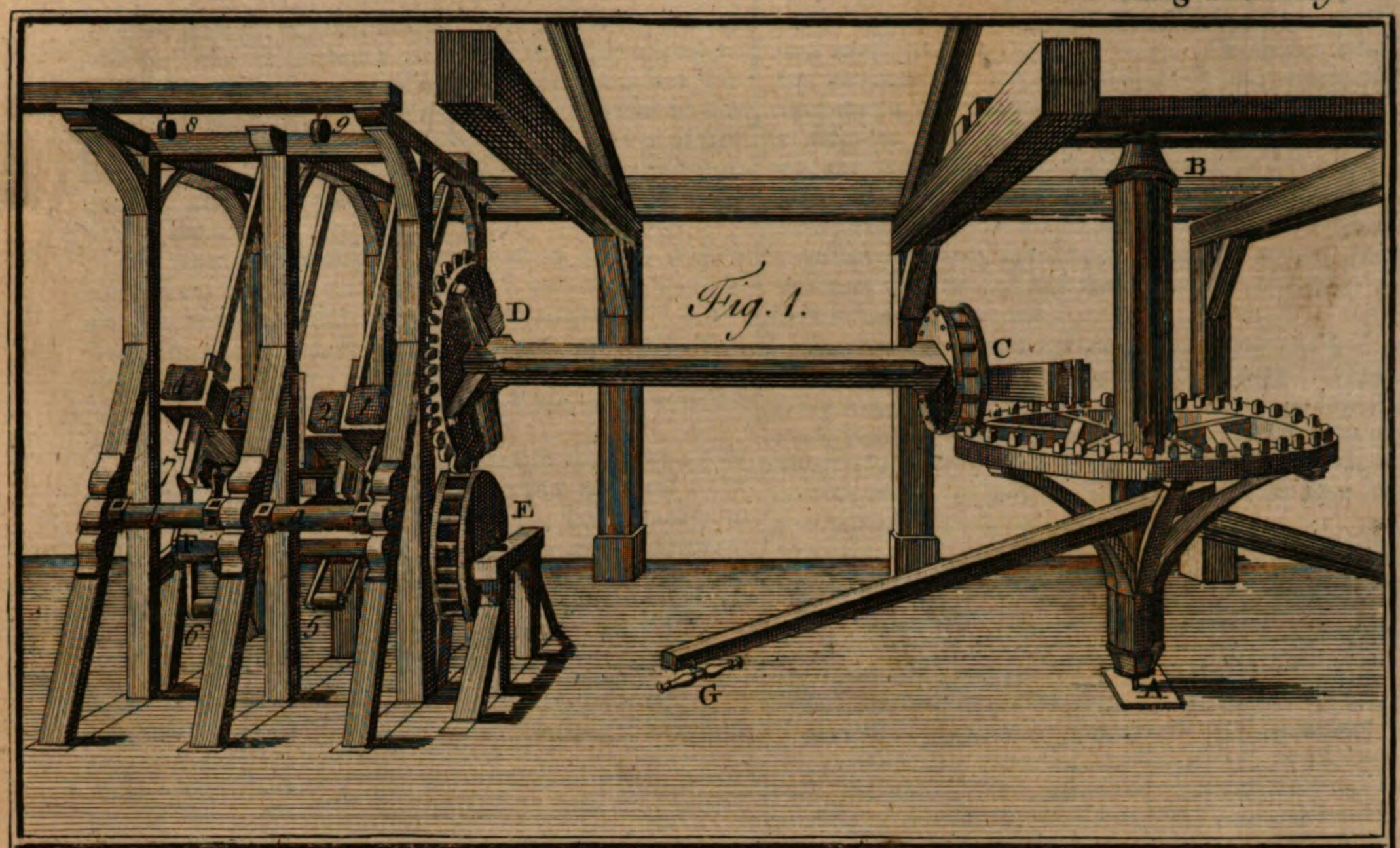


Fig. 1.

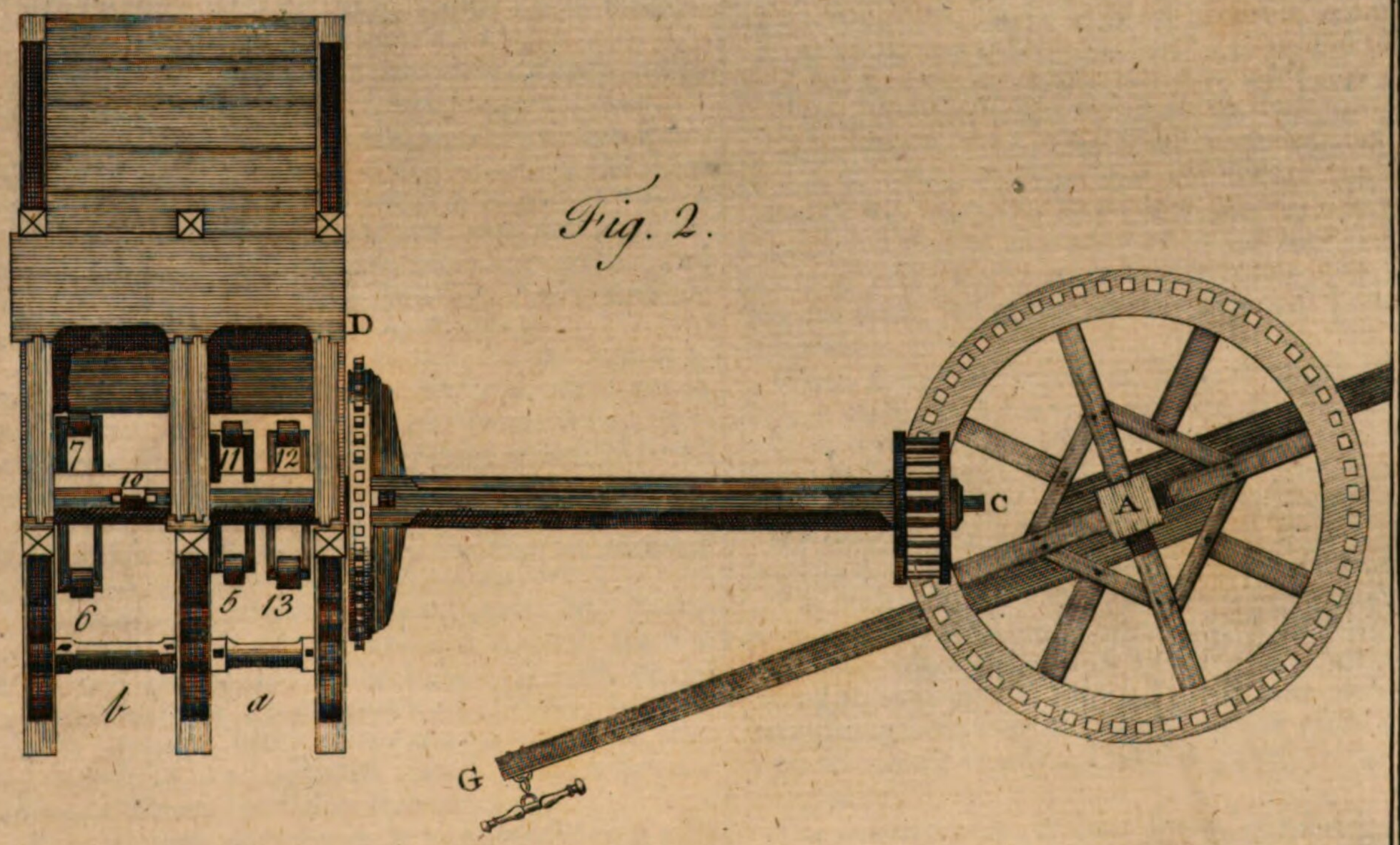


Fig. 2.

near the iron at the other end, there is an oblong ſquared hollow, called the ſocket; the uſe of which is to receive the bottom of the ſheat. Near the tail there is a thin plate of iron, well riveted to the wood; by means of this plate the tail of the ſhare is held firmly to the hinder ſheat of the plough by a ſmall iron pin, with a ſkrew at the end, and a nut ſkrewed on it, on the inner or right ſide of the ſheat.

The point of the ſhare is that part in which it does not run up into the fin: this point is generally made of three inches and a half in length, and ſhould be flat underneath, and round at the top, and the lower part of it muſt be of hard ſteel. The edge of the fin ſhould alſo be well ſteeled, and ſhould make an acute angle with the ſhare.

The ſocket is a ſort of mortiſe; it ſhould be a foot long, and about two inches deep: the fore-end of it muſt not be perpendicular, but oblique, conformable to the end of the ſheat which enters into it. The upper edge of the fore-part muſt be always made to bear againſt the ſheat; but, if this end of the ſocket ſhould not be quite ſo oblique as the ſheat, it may be helped by paring off a ſmall part of the wood at the point.

SHARK, in ichthyology, is the name of a very large fiſh, of which there are two ſpecies, diſtinguiſhed by their different colours, blue and white.

The blue ſhark is a very terrible fiſh of prey; growing to ſeven or eight feet in length, and conſiderably thick in proportion; the mouth is capacious, and furniſhed with large broad teeth, ſome of them ſerrated at the edges.

The white ſhark is flat-backed, and is larger and has a greater number of teeth than the preceding, ſome of them weighing near a thouſand pounds.

SHARP, in muſic, a kind of artificial ſemi-tone. See the article CHARACTER.

SHAW, a word uſed by our old writers, to ſignify a grove of trees.

SHEARING, or SHEERING, ſee the article SHEERING.

SHEAT *of a Plough*, that part of the plough which paſſes through the beam, and is faſtened to the ſhare.

The ſheat, or as it is ſometimes called the fore-ſheat, there being another piece of timber behind it called the hinder ſheat, ſhould be ſeven inches wide, and faſtened to the beam by a retch (a piece of iron with two legs) and by a wedge driven by it into the hole of the beam. The angle contained between the ſheat and the beam of the plough ſhould be about forty-two degrees.

SHEEP, *ovis*, in zoology, a well known ſpecies of cattle, and which are kept at the leaſt expence of any to the farmer. They will thrive upon almoſt any ground, and for that reaſon are preferred by many before the larger cattle.

The beſt ſort of ſheep for fine wool are thoſe bred in Herefordſhire and Worceſterſhire, but they are ſmall and black-faced, and bear but a ſmall quantity.

Warwick, Leiceſterſhire, Buckingham, and Northamptonſhire breed a large-boned ſheep, of the beſt ſhape, and deepeſt wool we have got. The marſhes of Lincolnſhire breed a very large kind of ſheep, but their wool is not good, unleſs the breed be mended by bringing in ſheep of other countries among them, which is a ſcheme of late very profitably followed there.

The northern counties in general breed ſheep with long, but hairy wool: and Wales breeds a ſmall hardy kind of ſheep which has the beſt-taſted fleſh, but the worſt wool of all.

The farmer ſhould always buy his ſheep from a worſe land than his own, and they ſhould be big-boned, and have a long greaſy wool, curling cloſe and well. Theſe ſheep always breed the fineſt wool, and alſo are the moſt approved of by the butcher for ſale in the market.

For the choice of ſheep to breed, the ram muſt be young, and his ſkin of the ſame colour with his wool, for the lambs will be of the ſame colour with his ſkin. He ſhould have a large long body, a broad forehead, round, and well riſing, large eyes, and ſtraight and ſhort noſtrils. The polled ſheep, that is, thoſe which have no horns, are found to be the beſt breeders. The ewe ſhould have a broad back, a large bending neck, ſmall, but ſhort; clean and nimble legs, and a thick deep wool covering her all over. To know whether they be ſound or not, the farmer ſhould examine the wool that none of it be wanting, and ſee that the gums be red, the teeth white and even, and the briſket ſkin red, the wool firm, the breath ſweet, and the feet not hot. Two years old is the beſt time for beginning to breed, and their firſt lambs ſhould not be kept too long, to weaken them by ſuckling, but be ſold as ſoon as conveniently may be. They will breed advantageouſly, till they are ſeven years old.

The farmers have a method of knowing the age of a ſheep, as a horſe's is known, by the mouth. When a ſheep is one ſhear, as they expreſs it, it has two broad teeth before; when it is two ſhear, it will have four; when three, ſix; when four, eight; after this their mouths begin to break. The difference of land makes a very great difference in the ſheep.

The fat paſtures breed ſtraight tall ſheep, and the barren hills and downs breed ſquare ſhort ones; woods and mountains breed tall and ſlender ſheep, but the beſt of all are thoſe bred upon new plowed land, and dry grounds. On the contrary, all wet and moiſt lands are bad for ſheep, eſpecially ſuch as are ſubject to be overflowed, and to have ſand and dirt left on them. The ſalt marſhes are, however, an exception to this general rule, for their ſaltneſs makes amends for their moiſture; any thing of ſalt, by reaſon of its drying quality, being of great advantage to ſheep.

As to the time of putting the rams to the ewes, the farmer muſt conſider at what time of the ſpring his graſs will be fit to maintain them and their lambs, and whether he has turneps to do it till the graſs comes; for very often both the ewes and lambs are deſtroyed by the want of food; or, if this does not happen, if the lambs are only ſtunted in their growth by it, it is an accident that they never recover. The ewe goes twenty weeks with lamb, and according to this it is eaſy to calculate the proper time. The beſt time for them to yean is in April, unleſs the owner has very forward graſs, or turneps, or the ſheep are field ſheep, where you have not incloſures to keep them in, then it may be proper they ſhould yean in January, that the lambs may be ſtrong by May-day, and be able to follow the dam over the fallows, and water furrows; but then the lambs that come ſo early, muſt have a great deal of care taken of them, and ſo indeed ſhould all other lambs at their firſt falling, elſe, while they are weak, the crows and magpies will peck their eyes out.

When ſheep are turned into fields of wheat or rye to feed, it muſt not be too rank firſt, for, if it be, it generally throws them into ſcowerings. Ewes that are big ſhould be kept but bare, for it is very dangerous to them to be fat at the time of their bringing forth their young. They may be well fed indeed, like cows, a fortnight before-hand, to put them in heart. *Mortimer's Huſbandry.*

The feeding ſheep with turneps is one great advantage to the farmers, from the crops they raiſe of them: they ſoon fatten upon them, but there is ſome difficulty in getting them to feed on them; the old ones always refuſe them at firſt, and will ſometimes faſt three or four days, till almoſt famiſhed; but the young lambs fall to at once.

The common way, in ſome places, of turning a flock of ſheep at large into a field of turneps, is very diſadvantageous, for they will thus deſtroy as many in a fortnight, as would have kept them a whole winter. There are three other ways of feeding them on this food, all of which have their ſeveral advantages.

The firſt way is to divide the land by hurdles, and allow the ſheep to come upon ſuch a portion only at a time, as they can eat in one day, and ſo advance the hurdles farther into the ground daily, till all be eaten. This is infinitely better than the former random method, but they never eat them clean even this way, but leave the bottoms and outſides ſcooped in the ground; the people pull up theſe indeed with iron crooks, and lay them before the ſheep again, but they are commonly ſo fouled with the creature's dung and urine, and with the dirt from their feet, that they do not care for them; they eat

but

but little of them, and what they do, does not nouriſh them like the freſh roots.

The ſecond way is by incloſing the ſheep in hurdles, as in the former; but in this they pull up all the turneps they ſuppoſe the ſheep can eat in one day, and daily remove the hurdles over the ground, whence they have pulled up the turneps: by this means there is no waſte, and leſs expence, for a perſon may in two hours pull up all thoſe turneps; the remaining ſhells of which would have employed three or four labourers a day to get up with their crooks out of the ground, trodden hard by the feet of the ſheep; and the worſt is, that as, in the method of pulling up firſt, the turneps are eat up clean; in this way, by the hook, they are waſted, the ſheep do not eat any great part of them, and when the ground comes to be tilled afterwards for a crop of corn, the fragments of the turneps are ſeen in ſuch quantities on the ſurface, that half the crop at leaſt ſeems to have been waſted.

The third manner is to pull up the turneps, and remove them in a cart or waggon to ſome other place, ſpreading them on a freſh place every day; by this method the ſheep will eat them up clean, both roots and leaves. The great advantage of this method is, when there is a land not far off which wants dung more than that where the turneps grow, which perhaps is alſo too wet for the ſheep in winter, and then the turneps will, by the too great moiſture and dirt of the ſoil, ſometimes ſpoil the ſheep, and give them the rot. Yet ſuch ground will often bring forth more and larger turneps than dry land, and when they are carried off, and eaten by the ſheep on plowed land in dry weather, and on green ſward in wet weather, the ſheep will ſucceed much the better; and the moiſt ſoil, where the turneps grow, not being trodden by the ſheep, will be much fitter for a crop of corn, than if they had been fed with the turneps on it. The expence of hurdles, and the trouble of moving them is ſaved in this caſe, and this will counterbalance at leaſt the expence of pulling the turneps, and carrying them to the places, where they are to be eaten. They muſt always be carried off for oxen. *Tull's Horſe-hoeing Huſbandry.*

SHEEP'S *Dung*, is one of the beſt manures we know. It ſucceeds better upon cold clayey lands, than any other dung whatever; but, as it is not ſo conveniently to be collected as the dung of larger animals, it is commonly conveyed to the land it is intended for, by folding the ſheep upon it. The urine, as well as the dung, is thus given to the land, and is of very great advantage; but the farmer always ſhould plow in this ſort of manure as ſoon as he can, for the ſun ſoon robs it of a great part of its virtue.

In Northamptonſhire they begin to fold the ſheep upon the lands that they would dung by them, after the month of July, and, the drier the lands are, the later they fold them. In Flanders they make many thouſand loads of manure annually from their ſheep: they cover the bottom of the folds conſiderably deep with ſome light and ſpungy earth, and, when this has received the dung and urine of the animals for ſeven or eight days, they remove it, and lay freſh in its place: the earth, thus impregnated, becomes an excellent improvement to land, and they raiſe large crops by means of it, in places where very little could be expected without it.

In England we have a contrivance like this, which is the covering the bottoms of the folds deep with ſand, and changing it once in a week, or thereabouts: this is a kind of manure finely calculated for clayey lands, both the ſand, and this peculiar kind of dung, being appropriated things for it.

SHEEP-NOSE *worms*, in natural hiſtory, a ſpecies of fly-worm, found in the noſes of ſheep, goats, and ſtags, and produced there from the egg of a large two-winged fly.

The frontal ſinuſes above the noſe in ſheep, and other animals, are the places where theſe worms live, and attain their full growth. Theſe ſinuſes are always full of a ſoft white matter, which furniſhes theſe worms with a proper nouriſhment, and are ſufficiently large for their habitation; and when they have here acquired their deſtined growth, and come to the ſtate in which they are fit to undergo their changes for the fly-ſtate, they leave their old habitation, and, falling to the earth, bury themſelves there; and, when theſe are hatched into flies, the female, when ſhe has been impregnated by the male, knows that the noſe of a ſheep, or other animal, is the only place for her to depoſit her eggs, in order to their being hatched. *Reaumur's Hiſt. Inſect.*

SHEERING, or SHEARING, in the woollen manufacture, implies the cutting off, with large ſheers, the too long nap, in order to render the cloth more ſmooth and even.

SHEKEL, a coin in uſe among the ancient Jews, and worth two ſhillings and three-pence farthing ſterling.

SHELF, among miners, implies the ſame with what they otherwiſe call ſoft ground, or faſt country; being that part of the internal ſtructure of the earth, which they find lying even, and in an orderly manner, and having evidently retained its primitive form and ſituation unmoved by the waters of the univerſal deluge, while the circumjacent and upper ſtrata have plainly been removed from their original place.

SHELL, *Concha*, in natural hiſtory, a hard, and as it were ſtony covering, with which certain animals are defended, and thence called ſhell fiſh.

As to the formation of a ſhell, it is now generally allowed to be formed by a viſcous fluid compoſed of glue, and ſeveral ſandy particles of an exquiſite fineneſs, which are tranſmitted through an infinite number of little channels to the pores where it tranſpires, condenſes, and hardens. When the animal increaſes in bulk, and the extremity of her body is not ſufficiently covered, it continues to evacuate and build in the ſame manner, finiſhing or repairing her habitation. This viſcous matter is proved, by undeniable experiments, to ariſe from the body of animals, and not from the ſhell, as ſome have imagined. Thoſe ſtreaks and clouds which we obſerve moſt ſhells to be beautified with, proceed, probably, from the different diſpoſition of the extreme parts of the animal's body that are viſible at the aperture of the ſhell, where we may frequently diſcover ſome minute lobes or lines of fleſh that differ from the reſt in colour, containing, perhaps, different juices which may acquire a particular complexion in that place; and many other different cauſes may concur to paint, vein, and diverſify the colours with a more or leſs lively glow. The quality of the food, the health or indiſpoſition of the animal, the inequality of its conſtitution according to the ſeveral periods of her age, and the changes that may happen to the different perforation of her ſkin; in ſhort, a thouſand accidents may intervene, to heighten or diminiſh certain tints, and diverſify the whole to infinity.

If the ſkill, in the variety of its colours, imitates the diverſity of the animal's pores, it is ſtill more apparent that it muſt aſſume the form of the body on which it is moulded. Thus we obſerve in all ſea-ſhells, that if the animal has any ſwelling or inequality on its body, a tumor likewiſe riſes in the correſponding part of the incruſtation. When the creature diſplaces herſelf, and enlarges the dimenſions of her dwelling, the ſame tumor which had already raiſed the ſhell in one part, ſwells it anew at a little diſtance, by which means you ſee the ſame ſpecies of inequality in a winding line round the ſhell. Sometimes theſe protuberances of the animal are ſo large, or ſo pointed, that thoſe which riſe them in the ſhell reſemble horns. She afterwards fills the inſide of theſe cavities; and then, by new evacuations of ſweat, ſtrikes out another ſet of horns, which protect her from ſuch fiſhes as are fond of her fleſh. If her body happens to be channelled, the ſhell that covers it has the ſame configuration: if the fleſh riſes in ſwellings winding round her in the form of a ſcrew, the ſhell has likewiſe its elevations and depreſſions, carried on in a ſpiral line from her tail to the other extremity of her body.

Foſſile SHELLS, thoſe found buried at a great diſtance from the ſea, in the bowels of the earth.

The number and variety of ſea ſhells which are found far from ſeas buried at great depths in the earth, and often immerſed in the hardeſt ſtones, is an object of great wonder.

Of theſe ſome are found remaining almoſt entirely in their native ſtate, but others are variouſly altered by being

ing impregnated with particles of ſtone, and of other foſſils; in the place of others there is found mere ſtone or ſpar, or ſome other native mineral body, expreſſing all their lineaments in the greateſt nicety, as being formed wholly from them, the ſhell having been firſt depoſited in ſome ſolid matrix, and thence diſſolved by very ſlow degrees, and this matter left in its place, on the cavities of ſtone and other ſolid ſubſtances, out of which ſhells have been diſſolved and waſhed away, being afterwards filled up leſs ſlowly with theſe different ſubſtances, whether ſpar or whatever elſe: theſe ſubſtances, ſo filling the cavities, can neceſſarily be of no other form than that of the ſhell, to the abſence of which the cavity was owing, though all the nicer lineaments may not be ſo exactly expreſſed. Beſides theſe, we have, alſo, in many places, maſſes of ſtone formed within various ſhells; and theſe, having been received into the cavities of the ſhells while they were perfectly fluid, and having therefore nicely filled all their cavities, muſt retain the perfect figures of the internal part of the ſhell, when the ſhell itſelf ſhould be worn away, or periſhed from their outſide. The various ſpecies we find of theſe are, in many genera, as numerous as the known recent ones; and as we have in our own iſland not only the ſhells of our own ſhores, but thoſe of many other very diſtant ones; ſo we have alſo many ſpecies, and thoſe in great numbers, which are, in their recent ſtate, the inhabitants of other yet unknown or unſearched ſeas and ſhores. The cockles, muſcles, oiſters, and the other common bivalves of our own ſeas are very abundant: but we have alſo an amazing number of the nautilus kind, particularly of the nautilus Græcorum, which, though a ſhell not found living in our own, or any neighbouring ſeas, yet is found buried in all our clay-pits about London, and elſe-where; and the moſt frequent of all foſſil ſhells in ſome of our counties are the conchæ anomiæ, which yet we know not of in any part of the world in their recent ſtate. Of this ſort, alſo, are the cornua ammonis and the gryphitæ, with ſeveral of the echnatæ and others.

The exact ſimilitude of the known ſhells recent and foſſil, in their ſeveral kinds, will by no means ſuffer us to believe, that theſe, though not yet known to us in their living ſtate, are, as ſome have idly thought, a ſort of luſus naturæ. It is certain, that, of the many known ſhores, very few, not even thoſe of our own iſland, have been yet carefully ſearched for the ſhell-fiſh that inhabit them; and, as we ſee in the nautilus Græcorum an inſtance of ſhells being brought from very diſtant parts of the world to be buried here, we cannot wonder that yet unknown ſhores, or the unknown bottom of deep ſeas ſhould have furniſhed us with many unknown ſhell-fiſh, which may have been brought with the reſt; whether that were at the time of the general deluge, or the effect of any other cataſtrophe of a like kind, or by whatever other means; to be left in the yet unhardened matter of our ſtony and clayey ſtrata.

The vaſt beds of foſſil ſhells, buried in many parts of the world, are not uſeleſs matter, but will ſerve to one of the greateſt purpoſes of huſbandry, the manuring of barren lands. The people of many parts of France, and in ſome places in our own country, dig up the maſſes of broken ſhells, connected into a ſort of ſtrata by marly, or other earths, for this purpoſe; and, ſpreading them upon the lands as dung, they ſoon moulder away, and are found extremely beneficial to the earth. Mr. Reaumur, deſirous of knowing in what manner theſe fragments of ſhells fertiliſed land, at firſt conjectured that they did the ſame as the various ſpecies of marls, diſſolving wholly away in time, and entering into, and fattening the earth; and carried it ſo far, as to believe that the common marls were a ſort of earth, which owed its origin merely to ſuch fragments of ſhells more perfectly diſſolved; and conſequently, that the rain and air, in ſome ſort, converted theſe ſhells into marl upon the earth. But he was ſoon convinced of the error of this opinion, by the experience of the peaſants, from whom he found that there was marl in the ſame pits whence they dug theſe ſhells, and that they uſed it alſo as manure, but to lands of a very different kind; thoſe which received benefit from the marl being always injured by the ſhells, and, on the contrary, thoſe which were meliorated by the ſhells receiving no benefit from the marl. It might naturally enough be ſuppoſed that the ſalts, contained in theſe foſſil ſhells, helped to fertiliſe the earth, in the ſame manner with the ſalts of the common ſea plants, which are uſed as manure in many places. It is not impoſſible, but that the ſalts may indeed have their uſe in the whole, but the great good theſe ſhelly fragments do to the lands they are uſed on, is to be explained in a much eaſier manner, when the nature of the lands, on which they are employed, is conſidered.

Theſe are uſually cold clayey lands, on which nothing can grow but heath, and a few uſeleſs weeds, the common plants not ſhooting in any ſtrength or perfection upon them; and they are always very wet upon the ſurface after any little rain, their texture being ſo cloſe and compact, that the water cannot penetrate into them as it does into the ſpungy texture of the common fertile lands. This ſort of manure, which is very light, and is no other than a maſs of broken, and, as it were, half calcined ſhells, mixing with this earth, breaks its particles, and occaſions a multitude of voids and little cavities in it, which reduce it to ſomething like the common ſtate of other earth, and the rain penetrates it as it does other mould.

The effects of this ſort of manure are very laſting; a land well ſtrewn with theſe ſhells is manured for twenty years, and the rain no longer wets its ſurface only, but penetrates its ſubſtance, and moiſtens the roots of plants ſown in it. Theſe find alſo an eaſier paſſage, and penetrate to a proper depth; while the plowman finds no leſs the benefit; his plough now eaſily turning up an earth, which before it was ſcarce able to cut. Some have imagined, indeed, that all theſe effects are owing to the ſalts in the ſhells operating in the manner of thoſe of dung, and by that means breaking the connections of the more minute molecules; but ocular examination will ſhew the ſhells act, in this caſe, merely as particles of hard matter of that ſize and hardneſs, and do no more than fragments of ſtone of the ſame ſize would do; and the peaſants are well acquainted with this, as they find it neceſſary to dung thoſe lands, which they have before manured with ſhells, in the ſame manner as they do any others.

There are in many foreign countries, as well as in our own, lands of ſuch a nature, that they never will become fertile, unleſs a large quantity of ſand is diſperſed over them. Theſe lands are all of the ſame nature with thoſe on which the farmers find their manure of ſhells to take effect. The ſand, and this manure of ſhells, evidently act upon the ſame principle, in meliorating land, which is only by dividing its parts, when naturally too compact; but the ſhells are qualified to do it greatly the better of the two, becauſe they are in themſelves ſo conſiderably lighter. Somewhat analogous to this ſort of manure is that of the throwing pebbles and rough fragments of ſtone on ſome earths, which are naturally tough and compact in a great degree. It is the general practice in huſbandry to take off all the ſtones, as far as it can be done, from the lands: but theſe ſoils are apt to crack, and burſt open in dry ſeaſons, and the more ſtones are mixed with them, the leſs they are obſerved to crack, and what cracks they have are always the ſmaller and ſhorter. The earth is, by theſe ſtones, divided into ſo many ſeparate parcels, that no very large and continued cracks can be formed; and always become the more fruitful the more ſtones it has upon it, provided they be not too large.

The manure of ſhells upon theſe lands, does not produce nearly ſo great an effect for the two firſt years, as it does in the ſucceeding ones: the reaſon of which is, that it is not at firſt ſufficiently mixed, but in ſucceeding time it breaks itſelf into a number of very ſmall particles, and theſe all become intimately blended with the molecules of the earth, and produce their effect more perfectly.

SHERIFF, an officer in each county of England, nominated by the king, inveſted with a judicial and miniſterial power, and who takes place of every nobleman in the county, during the time of his office. His judicial authority conſiſts in hearing and determining cauſes in his county-court, and in keeping the peace of the county; he being by the common law the principal conſerva-

tor of the peace there; for which reaſon he is to aſſiſt the juſtices, and raiſe the poſſe comitatus when occaſion requires; and ſuch perſons, as on a hue and cry he ſhall apprehend upon ſuſpicion of felony, he is to commit to priſon; he may alſo impriſon any one who breaks the peace in his preſence. The miniſterial office of the ſheriff conſiſts in proclaiming ſtatutes, and making returns of writs for electing knights of the ſhire, &c. He collects the king's rents, ſeizes the profits of lands forfeited, and the goods of felons, levies the king's debts, fines, amercements, &c. and is accountable to the king for the profits of the county, on which account the ſum of 4000 l. is ſet apart and annually allowed to the ſheriffs of the ſeveral counties of England, to help them to paſs their accounts, and to defray their expences at the aſſizes, &c. where no ſheriff is obliged to keep a table for the entertainment of any perſons but thoſe of his own retinue; neither is he to have above forty ſervants in livery, or leſs than twenty attending him. It is alſo his office to execute the writs and proceſſes out of the king's court; and no proceſs is to be ſerved but by the ſheriff. He returns juries for trials, as well in civil as in criminal caſes, except where there is cauſe of challenge againſt him, in which caſe they are to be returned by the coroner. And, laſtly, the ſheriff is to ſee that criminals are executed, and the order of law obſerved in putting them to death. A ſheriff has uſually under him an under-ſheriff, bailiffs, and a goaler, for all of whom he is anſwerable. An under-ſheriff ought always to have his deputy in the courts of juſtice, in order to receive their commands, and give an account of buſineſs, &c. All returns made by the under-ſheriff are in the name of the high-ſheriff; and for every default in the execution of his office, either by fraud or neglect, the high-ſheriff is amerceable in the exchequer. On the death of any ſheriff, the under-ſheriff ſhall officiate in his name, till another is appointed, and alſo be anſwerable, &c.

SHIELD, a weapon of defence uſed by the ancients; it was in the form of a light buckler, and borne on the arm, in order to turn off the ſtroke of lances, darts, javelins, &c.

SHIELD, in heraldry, implies the eſcutcheon, or field, on which the bearings of coats of arms are placed.

SHILLING, an Engliſh ſilver coin, twenty of which are equal to a pound ſterling. See COIN.

SHINGLES, among builders, are ſmall pieces of wood, in the form of wedges, four or five inches broad, and eight or nine long. They are uſed inſtead of tiles or ſlates for covering the roofs, &c. of buildings.

SHINGLES, in medicine; ſee the article HERPES.

SHIP, a general name for all large veſſels managed upon the ſea by the aſſiſtance of ſails and the helm.

A ſhip is known to be a great hollow machine compoſed of various parts and deſigned for various uſes. The principal parts of which it is compoſed are the hull, maſts, ſails, and rigging: the principal ends for which it is formed are burden, paſſage, or war; ſo that the chief qualities required in the conſtruction are capacity, velocity, and ſtrength.

With regard to the invention and improvement of ſhips among the ancients, as well as their manner of equipping and conducting them; of arranging them in the order of battle and engaging in fight; of their ſails and oars, their implements, and machines for war; we have already deſcribed theſe affairs at large in the articles NAVAL *Architecture*, NAVAL *Engagement*, and NAVIGATION.

A ſhip is navigated, or carried along, on the water by the action of the wind upon her ſails, and the direction of her motion is governed by the effort of the helm, which acts upon her hind-part, like the tail of a fiſh.

The ſails are expanded upon maſts, to receive the current of wind; of theſe there are a great variety, according to the ſize of the ſhip, the place where ſhe is built, or the force and direction of the wind. The form of ſails are extremely different; but are generally either trapezias, or near the form of a ſquare, or parallelogram, excepting ſtay ſails and lateen ſails, which are all uſually triangular.

The maſts are more or leſs in number, according to the ſize or figure of the ſhip, which alſo determines her name: and, as the effort of the wind on the ſails ſtrains the maſts conſiderably, it is neceſſary to ſupport them by ſtrong ropes, reaching from their tops to the ſhip's ſide, called ſhrouds; they are alſo ſuſtained by other great ropes, from the fore part of the ſhip, called ſtays. See MAST, SHROUDS, STAY, and SAILS.

A maſt, in large veſſels, is uſually compoſed of three pieces, the lower maſt, the top-maſt, and top-gallant-maſt. See MAST.

Every ſhip has three maſts, viz. the main-maſt, fore-maſt, and mizen-maſt, beſides the bowſprit. Each of theſe is furniſhed with three yards, viz. the lower yard, the top-ſail-yard, and the top-gallant-yard. The bow-ſprit has alſo two yards, viz. the ſprit-ſail and ſprit-ſail top-ſail-yard. Theſe are employed to extend the upper-edges of the ſails. See BOW-SPRIT and YARD.

Amongſt the variety of ſhips uſed in different countries, the principal are thoſe of three maſts, which are either known ſimply by the name of ſhips, which comprehends all the capital ones, or of galleons, galleaſſes, frigates, hag-boats, cats, fly-boats, barks, pinks, polacres, zebecks, which are all mentioned in their proper places.

Thoſe of two maſts are either ſnows, doggers, ketches, bilanders, brigs or brigantines, ſchooners, hermaphrodites, ſettees, gallies, barca-longas or ſhallops. See SNOW, DOGGER, &c.

And laſtly thoſe of one maſt, are ſloops, tartans, beancods, ſmacks, hoys, &c. All under this ſize are uſually denominated boats. See the article BOAT.

With regard to the motion of a ſhip on the water, it is already treated of in the articles NAVIGATION and SAILING.

"A royal ſhip ſhould appear noble, magnificent, and eaſy, in order to which, 1. She ought to ſtow or carry her ſtores, proviſion, ammunition completely. 2. She muſt be roomy for her number of men, to preſerve their health, and make life comfortable, with apartments convenient for her officers, &c. 3. She ſhould be eaſy at ſea, and at anchor. 4. She ſhould ſail and work well." *O Brien's Naval Evolutions.*

To illuſtrate what has been ſaid on this ſubject, we have exhibited to our readers a repreſentation of a firſt rate ſhip of war with all her maſts, yards, and rigging, erect, and the ſeveral ſails furled to their reſpective yards and ſtays.

Explanation of plate CXVI.

Parts of the hull.

A, the cat-head,
B, the fore-chains,
C, the main-chains,
D, the mizen-chains,
E, the entering-port,
F, the hawſe-holes,
G, the poop-lanthorns,
H, the cheſs-tree,
I, the head,
K, the ſtern.

Bowſprit and its rigging,

L, the bowſprit,
1, 2, ſprit-ſail and yard,
3, fore-ſtay ſail netting,
4, the horſe,
5, bob-ſtay,
6, ſprit-ſail-ſheets,
7, pendants,
8, braces and pendants,
9, haliards,
10, lifts,
11, clue-lines,
12, horſes,
13, bunt-lines,
14, ſtanding lifts,
15, cap,
16, flying-jib boom,
17, jib ſtay,
18, haliards,
19, ſheets,
20, horſes,
21, jib furled on the boom,
22, ſprit-ſail, top-ſail, and yard,
23, horſes,
24, braces,
25, clue-lines,
26, lifts,
27, ſheets,
28, haliards,
29, bunt-lines,
30, horſes.

N, the fore-maſt,

31, runner and tackle,
32, 33, ſhrouds,
34, laniards,
35, fore ſtay and laniard,
36, preventer-ſtay and laniard,
37, wooldings of the maſt,
38, fore-yard and ſail,
39, horſes,
40, fore-top,
41, crow-foot,
42, jeers,
43, yard-tackles,
44, lifts,
45, braces and pendants,
46, ſheets,
47, tacks,
48, bow-lines and bridles,
49, fore bunt-lines,
50, fore leech-lines,
51, fore-top rope,
52, futtock ſhrouds.

O, the fore-top-maſt,

53, 54, ſhrouds,
55, yard and ſail,
56, ſtay and ſail,
57, runner,
58, back-ſtays,
59, haliards,
60, lifts,
61, braces and pendants,
62, horſes,
63, clue-lines,
64, bow-lines and bridles,
65, reef-tackles,
66, ſheets,
67, bunt-lines,
68, croſs-trees,
69, cap.

P, the fore-top-gallant-maſt,

70, 71, ſhrouds and laniards,
72, yard and ſail,
73, back-ſtays,
74, ſtays,
75, lifts,
76, clue-lines,
77, braces and pendants,
78, bow-lines and bridles,
79, flag-ſtaff,
80, truck,
81, flag-ſtaff-ſtay,
82, flag of lord high-admiral.

Q, the main-maſt,

83, 84, ſhrouds,
85, laniards,
86, runner and tackle,
87, pendant of the garnet,
88, guy of ditto,
89, ſtay-ſail,
90, ſtay,
91, preventer-ſtay,
92, ſtay-tackle,
93, wooldings of the maſt,
94, jeers,
95, yard-tackles,
96, lifts,
97, braces and pendants,
98, horſes,
99, ſheets,
100, tacks,
101, bow-lines and bridles,
102, crow-foot,
103, top-rope,
104, top,
105, bunt-lines,
106, leech-lines,
107, yard and ſail.

R, the main-top-maſt,

108, 109, ſhrouds and laniards,
110, yard and ſail,
111, futtock-ſhrouds,
112, back-ſtays,
113, ſtay,
114, ſtay-ſail and ſtay and haliards,
115, runners,
116, haliards,
117, lifts,
118, clue-lines,
119, braces and pendants,
120, horſes,
121, ſheets,
122, bow-lines and bridles,
123, bunt-lines,
124, reef-tackles,
125, croſs-trees,
126, cap.

S, the main-top-gallant-maſt,

127, 128, ſhrouds and laniards,
129, yard and ſail,
130, back-ſtays,
131, ſtay,
132, ſtay-ſail and haliards,
133, lifts,
134, braces and pendants,
135, bow-lines and bridles,
136, clew-lines,
137, flag-ſtaff,
138, truck,
139, flag-ſtaff-ſtay,
140, flag-ſtandard.

T, the mizen-maſt,

141, 142, ſhrouds and laniards,
143, pendants and burtons,
144, yard and ſail,
145, crow-foot,
146, ſheet,
147, pendant-lines,
148, peek-brails,
149, ſtay-ſail,
150, ſtay,
151, derric and ſpan,
152, top,
153, croſs-jack-yard,
154, croſs-jack-lifts,
155, croſs-jack-braces,
156, croſs-jack-ſlings.

V, the mizzen-top-maſt,

157, 158, ſhrouds and laniards,
159, yard and ſail,
160, back-ſtay,
161, ſtay,
162, haliards,
163, lifts,
164, braces and pendants,
165, bow-lines and bridles,
166, ſheets,
167, clue-lines,
168, ſtay-ſail,
169, croſs-trees,
170, cap,
171, flag-ſtaff,
172, flag-ſtaff-ſtay,
173, truck,
174, flag-union,
175, enſign-ſtaff,
176, truck,
177, enſign,
178, poop-ladder.
179, bower-cable.

SHIP-BUILDING, the art of deſigning, conſtructing, and forming ſhips.

"It cannot be denied but that the art of ſhip-building, which is of ſo great an advantage to a ſtate, is (although greatly improved) the moſt imperfect and moſt undetermined of all arts. The beſt builders have ſeldom any regard to other parts of a ſhip beſides the two principal, viz. the head and ſtern; from hence it proceeds that the ſame builder, who builds two ſhips at the ſame time, and on the ſame plan, often builds them ſo unequal, that we find their qualities extremely different.

"Chance has frequently ſo great a ſhare in the conſtruction, that we ſee ſhips, built with the greateſt exactneſs and application, often prove the worſt; and thoſe which are built without any ſtrict regard to rules, anſwer the purpoſe much better: ſo that the largeſt ſhips are ſometimes the moſt defective; and we often find much better amongſt the merchant ſhips, than amongſt ſhips of war.

"It is true, that within theſe few years the French builders have endeavoured to bring their art to perfection. Some have begun by making plans, in which they have determined the ſeveral models, or draughts, of the fore and after parts of a ſhip; but as they want the neceſſary principles, they work with great uncertainty; their ſhips are not better than thoſe which were built without the knowledge of reading and writing; neither ſail better, nor bear ſo much ſail, nor laſt ſo long. In a word, the builders in our days are of the ſame opinion with the antients, that what agrees beſt with the ſea, is yet undetermined.

"I doubt not ſeveral able builders have flattered themſelves they have found in the practice of frequent and repeated eſſays, what they have not found in theory, but, I believe, they have been diſappointed in the ſucceſs; a ſhip is too complicated a machine, and there are too many things which muſt concur to render it complete, to leave its perfection to blind chance only. It very often happens in theſe caſes, that when artiſts deſign to make their work complete, they ſpoil it, by endeavouring to rectify what before conſtituted its perfection: beſides, the greater the eſſay or model, the greater will be the expence; and the ſmaller the model is formed, the more imperceptible will be the beauties or faults. We muſt however allow, that trials and experience are the beginning of all arts, when the works are yet but ſimple and undigeſted; but when they become more intricate or compounded, we muſt have reourſe to theory, to develop that multitude of confuſed circumſtances which perplex the artiſts, and lead them into numberleſs errors.

"I think the theory of ſhip-building ought to be reduced to the examination of three different articles: 1. Thoſe which determine the figure of a ſhip. 2. Thoſe which determine or contribute moſt to her ſolidity. 3. Thoſe which beſt facilitate her plans." *L' Hoſte's Theory of the Conſtruction of a Ship.*

In the article NAVAL ARCHITECTURE, we have deſcribed the principal parts of a ſhip, and exhibited their diſpoſition, and relation to each other in the plate thereto annexed. We ſhall here give ſome further account of the general rules obſerved in ſhip-building, and of the uniting thoſe members ſo as to form a ſolid that ſhall poſſeſs the chief qualities for which the ſhip is deſigned.

Shipwrights, in delineating the models of ſhips, make uſe of three planes, which they call the ſheer-plane, the floor-plane, and the body.

The ſheer-plane is the ſame with that of elevation, being a ſection of a ſhip ſuppoſed to be cut by a plane paſſing through the middle line of the keel, ſtem, and ſtern-poſt. The floor-plane is the ſame with the horizontal, and is that on which the whole frame is erected. The body is the ſame with the profile; being a ſection ſuppoſed to cut the ſhip through the broadeſt place, and is perpendicular to the ſheer and floor-planes.

The length of the keel, extreme breadth, depth in the hold, height between decks and in the waiſt, and ſometimes the height of the wing tranſom, are agreed on by contract in the merchants ſervice, from which dimenſions the builder is to form a draught ſuitable to the trade the ſhip is deſigned for. The firſt thing that is generally done, is to lay down the keel, ſtem, and poſt, upon the ſheer-planes: then to determine the proper ſtation of the mid-ſhip timber, where a perpendicular is erected: it is generally about $\frac{2}{3}$ of the keel before the poſt. On this line the given depth of the hold is ſet off from the upper ſide of the keel; to obtain which point, the thickneſs of the timber and plank muſt be added to that agreed on by contract. This, being fixed, will enable us to determine the upper height of the extreme breadth at that place, which ſometimes is the very

point

point itſelf. The lower height of the breadth muſt likewiſe be determined at this place. Then we may form the two main heights of the breadth lines, which nearly unite abaft and afore. Abaft theſe curves end at the wing tranſom, or above it; and, afore, they are carried up ſometimes as high as the hawſe holes. The height of the breadth line of the top timber muſt likewiſe be formed. This is generally done by a bow, which makes nearly an arch of a circle. It is limited in midſhips by contract, afore and abaft only by the fancy and judgment of the artiſt, according to what ſheer-plane he deſigns; we muſt alſo form a line for the riſing of the floor; for which purpoſe we muſt determine the dead riſing, which is that of the mid-ſhip timber. This limits it at that place, and, in the whole moulding, it is pretty near parallel to the lower height of the breadth lines. Theſe lines muſt abſolutely be drawn on the ſheer-plane, and correſponding to the main and top timber height of breadth-lines; there muſt be two half breadth lines formed on the floor plane.

The main half breadth at the mid-ſhip timber is agreed on by contract, only obſerving that the thickneſs of the timber and plank muſt be deducted out of it, becauſe it is the extreme breadth from outſide to outſide of the plank that is contracted for. Thoſe in the draughts are called moulded half breadths. Then the breadth at the wing tranſom, if a ſquare ſtern, is limited; it is generally about two thirds of the extreme breadth, but this is juſt as the artiſt ſhall think proper. He alſo fixes the breadth of the top timber, and then deſcribes the two half breadth lines. In the due formation of theſe curves on the ſheer and floor planes, the whole art of drawing chiefly conſiſts, which muſt be acquired by practice, ſo that it will be ſcarce poſſible for one, that is not very well acquainted with drawing, to form them, without having recourſe to ſome other draughts. After theſe are formed, the ſtations of the timbers are fixed; if the room and ſpace, and the breadth of the midſhip timber, are agreed on by contract, this will determine the ſtation of all the timbers; obſerving that the timbers abaft the mid-ſhips muſt be ſet off from the foreſide of the mid-ſhip timber; and the timbers before the midſhip from the aft ſide of it. At every third or fourth timber there muſt be perpendiculars drawn on the ſheer and floor planes, to the line that repreſents the lower edge of the keel, which is the common ſection of theſe two planes; though ſometimes the half breadth lines are deſcribed on the ſheer plane, when there is not ſpace to produce the perpendiculars till they be of ſufficient length to contain the height of the breadth and half breadth.

After the timbers are ſtationed, and the perpendiculars for the frames drawn on the ſheer and floor planes, we proceed to the body plane, and draw a line equal in length to the whole breadth moulded. This line may be called the baſe of the body plane. A perpendicular is erected at each end of it, and one in the middle, which may be produced at pleaſure.

The next thing to be done, is to form the mid-ſhip frame; the limits of it are had from the ſheer and floor planes; the lower, upper, and top timber heights of the breadth are taken from the ſheer plane at the perpendicular, repreſenting the midſhip frame, and ſet off on the middle line of the body plane from the baſe. Through theſe points, lines are drawn parallel to the baſe, and the reſpective half breadths, corresponding to each, are ſet off on theſe lines from the middle line in the body plane. The lower and upper main half breadths are limited by the perpendiculars already drawn at each end of the baſe. The half breadth of the top timber is had from the floor-plane on the perpendiculars repreſenting the midſhip frame. The height of the dead riſing is likewiſe taken from the ſheer-plane, and ſet up from the baſe upon the middle line in the body-plane, through which point a line parallel to the baſe muſt be drawn, and upon this line the half breadth of the floor is ſet off from the middle line; at which point a perpendicular is erected. The center of the floor ſweep is in this line, from which a circle muſt be deſcribed that ſhall juſt touch the riſing line. A proper radius for the under breadth ſweep is next to be found: the center of it is in the lower breadth line, from which it is deſcribed to paſs through the point which limits the half breadth. After which the radius, and center of a reconciling ſweep to join the floor and under breadth ſweeps, is found, and the circle deſcribed: and, to compleat the frame below the breadth, the half breadth of the keel is ſet off from the middle line on the baſe; from which point, a ſtraight line is drawn to touch the back of the floor ſweep.

By this way of forming the frame, it is plain the centers and radii of the ſweeps are arbitrary, but they muſt be determined before any of the other timbers can be formed; if by no other means, by repeated trials, till they are made to pleaſe the fancy and judgment of the artiſt. But there are various other ways of forming this frame; ſo that, though ſeveral ſhips may be of the ſame breadth, depth in the hold, and dead riſing, they may all differ in the form of their timbers. After this midſhip timber is formed, a pattern or mould is made to fit exactly to the curve, and the dead riſing line. By this, and a hollow mould, all the timbers are formed, ſo far as the riſing line and lower height of the breadth line are parallel to one another in the ſheer plane.

Having explained what the ſhip-wrights call whole moulding, we ſhall proceed to ſhew the method of forming the body by ſweeps.

In ſhips of war the general dimenſions are eſtabliſhed by the authority of thoſe appointed by the government for that purpoſe. The ſheer and floor planes are laid down in this, exactly in the ſame manner as in that of the whole moulding. We may have a ſufficient number of points from the dimenſions ſettled by authority to determine the heights of the breadth and half breadth lines. A riſing of the floor line muſt likewiſe be formed on the ſheer draught. We may then go to the body plane, and form the midſhip bend or frame timber; the limits of which we have from the ſheer and floor planes, and it muſt be formed in the ſame manner as before directed in whole moulding, either by two, three, or more ſweeps, as the artiſts ſhall think moſt ſuitable to the ſervice the ſhip is deſigned for. The lower, upper, and top timber heights of breadth, and riſings of the floor are ſet up on the middle line in the body plane, as in whole moulding, and lines drawn through theſe points parallel to the baſe upon which the half breadths are ſet off. A mould may then be made for the midſhip frame as before, and laid upon the ſeveral riſings in the ſame manner as in whole moulding, with this difference, that here an under breadth ſweep is deſcribed to paſs through the point which limits the half breadth of the timber; the center of which will be in the breadth line of that timber. The proper centers for all the frames being found, and the arches deſcribed, the bend mould muſt be ſo placed on the riſing line of the floor, that the back of it may touch the back of the under breadth ſweep. But the general practice is to deſcribe all the floor ſweeps with compaſſes as well as the under-breadth ſweeps, and to reconcile theſe two by a mould which is an arch of a circle; its radius being the ſame with that of the reconciling ſweep, by which the midſhip frame was formed. It is uſual for all the floor ſweeps to be of one radius; and, in order to find their centers, a line is formed on the floor plane for the half breadth of the floor: this, as was before obſerved, is only an imaginary one; for it cannot be deſcribed on the ſurface of the ſhip: inſtead of it ſome make uſe of a diagonal in the body plane, to limit the half breadth of the floor upon every riſing line, and erect perpendiculars at the ſeveral interſections in the ſame manner as for the midſhip frame, as in the draught; where it is very plain the floor ſweep conſtitutes no part of the after timbers abaft the ſquare body. After the ſweeps are all deſcribed, we muſt have recourſe to moulds, or ſome ſuch contrivance, to form the hollow of the timbers, much in the ſame manner as in whole moulding; and, when we have thus formed all the timbers, they muſt be proved by ribband and water-lines, as before directed; and altered, if needful, to make theſe lines fair; hence it is obvious, that the form of the ribband lines muſt be determined, before we can with certainty have the true form of the timbers. But there will be a neceſſity of determining at leaſt, the form of three timbers, viz. the midſhip, foremaſt, and aftermoſt, before

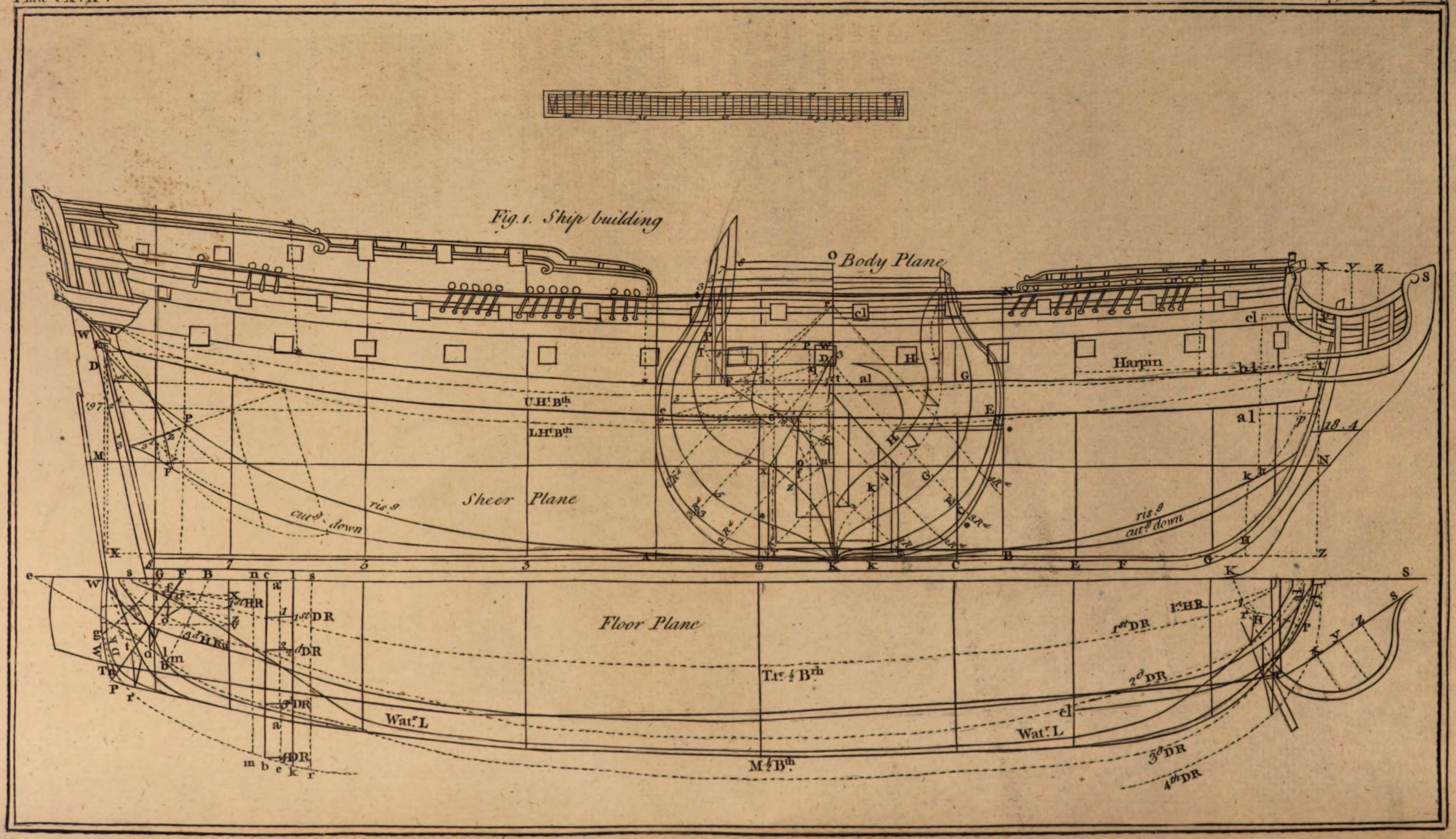


Fig. 1. Ship building
Body Plane
Sheer Plane
Floor Plane
Harpin
U.H.t B.th
L.H.t B.th
ris.g
cut.g down
Wat.r L
T.t.r ½ B.rh
M ½ B.th
1st DR
2d DR
3d DR
4th DR
18.4

before we can form a ribband line. Theſe will give three points, through which the curve of each ribband muſt paſs. The points in the intermediate timbers may be found by forming timbers as before directed; but by repeated trials, altering them till they make fair ribbands; for it is by them that the whole ſtructure is regulated, when every frame is erected into its proper place.

The general dimenſions being determined, and a ſcale adapted to the draught, take the half breadth with a pair of compaſſes, and placing one foot in the proper point for the half breadth of ⊕, which will be found in number V. open the ſector till the other foot reaches to the ſame point in the correſponding line on the other leg. See the article SHIPWRIGHTS-*Sector*.

The ſector being thus ſet, it will be indifferent whether we begin with the body or ſheer plane: let it then be the ſheer.

Firſt, draw the line X Z (plate CXVII.) to repreſent the upper edge of the keel, and length of the gun-deck; but it may be produced to the aft ſide of the wing tranſom, and fore part of the ſtem.

Secondly, erect a perpendicular to the line X Z, upon which ſet up the heights of the wing tranſom to W; taken from N°. IV. on the ſector.

Thirdly, take the rake of the poſt from number VII. on the ſector, and ſet it forward from the perpendicular of the wing tranſom to the point 7, where a perpendicular muſt be erected, which will be the ſtation of that timber.

Fourthly, take the diſtance of the frames from number III. on the ſector, and ſet it off from 7 to 8; and erect a perpendicular at that point for timber 8. Draw alſo a line from 8 to the wing tranſom, to repreſent the fore-part of the poſt.

Fifthly, take the height and rake of both counters, alſo the rake of the ſtern timber, from number II. The height of the ſtern timber is on number I. and by theſe form the counters, and upright of the ſtern.

Sixthly, ſtation the timbers, by taking the diſtance between the perpendiculars at 7 and 8; which at eight times will reach to ⊖; and erect perpendiculars at 5, 3, and ⊕. Then, for ſtationing the timbers in the fore-body, we muſt turn the ſector, and take the diſtance of the frames from number III. which, ſet eight times from ⊕, will reach to H. Erect perpendiculars at C, E, G, and H; and from G ſet off the diſtance of the gun deck before G. It is in number I. on the ſector, which will reach to Z; at which point erect a perpendicular, and ſet off the height of the gun-deck, taken from the ſector; and from the gun-deck ſet up the height of the head of the ſtem, alſo its diſtance before G; both taken from number I. We may then form the ſtem. The center of the ſweep is in the perpendicular of timber F, and the radius of the ſweep is upon the ſector between numbers III. and IV. which, ſet up from the point F, will give the center: ſo the ſweep will juſt touch the upper edge of the keel in the point F. And, as the ſweep will not reach to the gun-deck, we muſt make uſe of a mould to break in fair with the back of the ſweep.

Seventhly, ſet up the heights of the lower, upper, and top timber breadth lines upon the perpendiculars erected for the ſtations of the ſeveral timbers. The points, correſponding to each, are on their proper lines on the ſector.

Having thus finiſhed the ſheer plane, we may then go to the floor plane: and, producing all the perpendiculars for the timbers, we may upon them ſet off the main and top timber half breadths. The points correſponding to each are on their proper lines upon the ſector; which muſt be ſet off from the line W K, repreſenting the lower ſide of the keel, and may be produced both ways, as far as ſhall be needful. We muſt in the next place form all the ribband lines, which are the dotted ones in the draught; beginning with the fourth ribband. But it will be more expeditious, firſt, to draw all the diagonals in the body plane.

Let A B be the whole breadth, on the middle of which erect the perpendicular K O; ſo ſhall A K, or K B, be the half breadth. Upon the line K O, ſet up the ſeveral heights of the breadth lines, taken from the ſheer plane, and draw lines parallel to the baſe, as has been already directed; and likewiſe ſet off the half breadths correſponding to each, taken from the floor plane. We may alſo ſet off the height and half breadth of the wing tranſom; all which may be done without the ſector; but we muſt have recourſe to it for the dead riſing. This is in number III. in the after body, and muſt be ſet off upon the line K O, from the lower height of breadth to *i*. Through *i* draw the line *r i s*, parallel to the baſe, and ſet off the one half breadth of the floor from *i* to *r*, and from *i* to *s*: it is upon number VII. on the ſector. Then, taking *r i*, ſet it up from *i* upon the line K O, to which point draw the dotted diagonal marked R 1ſt. This regulates all the other diagonals: for, if one line be drawn from the point of this interſection, with the middle line, to the half breadth of the wing tranſom; and another from the point *r*, its interſecting with the riſing line, to the point ⊕, at the lower height of breadth; each of theſe may be divided into four equal parts by the dotted diagonals 2^d R^d, 3^d R^d, 4^d R^d.

Note, the lines from the ends of the firſt diagonal to the lower height of breadth, and to the wing tranſom, were drawn only with a black lead pencil, and wiped out after the diagonals were drawn. The diagonals being thus drawn, we may form the midſhip frame, for which purpoſe we muſt find a point in each diagonal, through which the curve of the timber muſt paſs. Theſe points we have from the ſector; which muſt be ſet off from the interſections of the diagonals with the line K O. That in the firſt diagonal is in number I. The point in the ſecond diagonal is in number VI. The point in the third diagonal is in number V. And the point in the fourth diagonal is between numbers I and II. This laſt muſt be doubled, becauſe the ſector will not contain the whole length. The midſhip frame being formed, we muſt in the next place form the after and foremoſt timber; which the ſector does, by giving the diſtance on every diagonal between theſe timbers, and the midſhip frame now formed: ſo that we ſhall have a point in each diagonal, through which the curve of the timber muſt paſs. To find the point in the firſt diagonal for the after timber, extend 1ſt, from ⊕ R in number V. to the correſponding point on the other leg. Set off this diſtance from ⊕ on the firſt diagonal: do the ſame upon the ſecond, third, and fourth diagonals. The point on the ſecond diagonal is in number IV. That on the third in number VI. And that on the fourth in number VII. The curve muſt paſs through theſe points, and likewiſe through the point for the half breadth, which was before ſet off from the ſheer and floor planes; by which means we have determined the form of the after timber; and the foremoſt timber is to be formed by the ſame method. Theſe two timbers being formed, we may find points in the diagonals for all the intermediate timbers. Thus, to find the point for timber 3 in the firſt diagonal, extend from the point 3 in the inner part of the line number V. to its correſponding point on the other leg. Set off this in the firſt diagonal from the after timber, already formed; which will give the point through which timber 3 muſt paſs; and, to find the point in the ſecond diagonal, we muſt extend from 3, in the inner part of the line number IV. and ſet off this diſtance in the ſecond diagonal from the after timber. The ſame method muſt be uſed to find the points in the third and fourth diagonals. In like manner we may find a point in each diagonal for the timbers 5 and 7, which will be ſufficient for the after body: and the ſame proceſs muſt be uſed to find points in each diagonal for the timbers in the fore body.

Having now found the points, before we form the timbers, it may be proper, by them, to form the ribbands: for now we may take the diſtance of each point in the diagonal, from its interſection with the middle line K O, and transfer it to the floor plane upon the perpendiculars that repreſent the planes of the timbers, as before directed. In order to limit the ends of the ribband lines on the floor plane, we muſt ſet off half the thickneſs of the poſt, on one ſide of the middle line K O, and half the thickneſs of the ſtem on the other ſide of it, on the body plane; firſt deducting the depth of the rabbet out of it. We muſt likewiſe determine the inner part of the rabbet on the ſtem, and upon the poſt in the ſheer plane. In the ſtem, it is generally in the middle between the lines that repreſent the outſide of the rabbet. It may be

alſo ſo on the poſt, from the wing to the lower tranſom; and from thence the line may be continued fair to interſect the line that repreſents the after ſide of the rabbet, at the upper edge of the keel; for there the rabbet is cut ſquare into the poſt.

Now it is obvious that, when the plane of any diagonal ribband is in its proper place and poſition, the line W K will be in the ſheer plane, parallel to the upper ſide of the keel; and its height will be the ſame with that of the point where the diagonal interſects the middle line in the body plane. But by reaſon of its inclination, and of the half thickneſs of the ſtem and poſt, the height of the plane of the ribband upon the poſt and ſtem will be in the point where the diagonal interſects the line that repreſents the rabbet in the body plane. This then muſt be transferred from the body to the ſheer plane, and ſet up from the upper edge of the keel upon a perpendicular that will interſect the line that repreſents the inſide of the rabbet at that height. This perpendicular may be produced into the floor plane; and, if that part of the diagonal intercepted between the middle line, and the line that repreſents the inſide of the rabbet, in the body plane, be ſet off upon the perpendicular, it will give the proper point for the end of the ribband line, as may be ſeen in the plate; where all the ribbands are dotted lines, and they are marked 1ſt D R, 2d D R, &c.

Note, the ſcale in the plate is ſo ſmall, that we have taken the outſide of the rabbet to limit the end of the ribband.

The ribbands being thus formed, we may from them form all the timbers below the breadth.

The next thing to be done, is to form the top timbers. We have the height and half breadth of each from the ſheer and floor planes; and the timbers below the breadth are carried up by a ſweep, which forms the lower part of the top timber. The center of this ſweep is in the upper height of the breadth line of the timber, and may be taken from the ſector: it is on number III. after body. The midſhip top timber has generally a hollow, which is left intirely to the artiſt; for ſome, eſpecially ſmall ſhips, have none. The general practice is to make a mould for this hollow, either by a ſweep, or ſome other contrivance, and produce it conſiderably above the height of the top timber in a ſtraight line, or very near one. The midſhip timber is formed by this mould, and ſo placed, that it breaks in fair with the back of the upper breadth ſweep. All the other timbers are likewiſe formed by the ſame mould; obſerving to place it ſo that the ſtraight part of it may be parallel to the ſtraight part of the midſhip timber; and moved up or down in that direction till it juſt touches the back of the upper breadth ſweep. Some begin at the after timber after the mould is made for the midſhip one, becauſe they think it eaſier keeping the ſtraight part of the mould parallel to this, than to the midſhip timber; and by this means the top ſide is kept from winding. Others again make a mark upon the mould where the breadth line of the midſhip timber croſſes it, and with the ſame mould they form the after timber. This will occaſion the mark that was made on the mould, when in midſhips, to fall below the breadth line of the after timber; and ſo another mark is made at the height of the breadth of the after timber.

The next thing to be done, is to lay the ſtraight part of the mould obliquely acroſs the breadth lines of the top timbers in ſuch a manner that it may interſect the breadth line of the midſhip timber at one of theſe marks, and the breadth line of the after timber at the other mark. Then the ſeveral interſections of the breadth lines of the timbers are marked upon the mould. The mould, being thus marked, muſt be ſo placed in forming each timber, that the proper mark may be applied to its proper breadth; and the mould be turned about ſo as juſt to ſweep the upper breadth ſweep. Any of theſe methods may make a fair ſide; but it may be eaſily proved by forming another half breadth line.

Hitherto, we have conſidered the timbers, as having their planes perpendicular both to the ſheer and floor planes. Theſe are called ſquare timbers: and, when they are all formed, we may from them form as many ribband and water lines as ſhall be neceſſary to form the cant timbers. Their planes are inclined to the ſheer, but perpendicular to the floor planes. The reaſon of canting theſe timbers is, that they may nearly be equally ſpaced at the breadth ribband: for, if the poſt has a conſiderable rake, and the timbers all ſquare, there will be a great ſpace at the breadth ribband, between timber 8 and the wing tranſom: beſides, the timber may be ſo canted, that it may be ſquare to ſome of the ribbands; whereas, if they were perpendicular to the ſheer plane, they would interſect the ribband lines ſo as to form very oblique angles; which would occaſion very great bevelling. Another advantage that attends canting the timbers, is, that they will not require ſuch compaſs timber.

It is uſual to begin the cant timbers from the aftermoſt floor timber, and ſpace them near equally on the breadth line to the wing tranſom: and, in order to ſpace them upon the keel, the cant of the faſhion piece muſt be determined. Now, if we ſuppoſe the plane of the faſhion piece to interſect the ſheer and floor planes in the point F, it muſt interſect the floor plane in the line F P, becauſe the point P is ſuppoſed to be the end of the wing tranſom. So the angle *s* F P will be its inclination to the ſheer plane. It will interſect the ſheer plane in a perpendicular erected from the point F; and, if the ſpace between the point F and the foremoſt cant timber upon the keel, be divided into the ſame number of equal parts, that the ſpace between the ſame timber, and the wing tranſom upon the breadth line, is divided into; this will determine the cant of all the timbers, only by drawing lines from all points in the line W K, to the correſponding points in the breadth line, in the ſame manner as the line F P determines the cant of the faſhion piece.

It would be needleſs to draw all theſe lines in the plate, the only intent of drawing them being to ſhew how to form the timbers by them: and as one method ſerves for all the cant timbers, which are ſuppoſed perpendicular to the floor plane, it will be ſufficient to ſhew the formation of the faſhion piece. Before any of the cant timbers can be formed, there muſt be a ſufficient number of water lines, or diagonal and horizontal ribband lines, formed from the ſquare timbers: and, when theſe are abſolutely determined, we may, with certainty, form all the cant timbers, either by water or ribband lines.

If we make uſe of the diagonal ribbands, which are diſtinguiſhed by the dotted curves in the floor plane, we muſt form an horizontal ribband correſponding to each. We have only laid down one of theſe horizontals in the plate, viz. that correſponding to the third diagonal: it is marked 3d H R. To form this ribband, fix one foot of the compaſſes in the point where the third diagonal interſects the midſhip frame in the body plane; and extend the other foot to touch the middle line K O; ſo that, if a line were drawn from one foot of the compaſſes to the other, it would be perpendicular to the line K O: this diſtance ſet off from the line W K, upon the perpendicular that repreſents ⊕ in the floor-plane, will give the point thro' which the curve muſt paſs at that place. The ſame method muſt be uſed for finding the points on all the other timbers.

Now, though the diagonal and horizontal ribbands ſeem to be quite different curves in the plates, they will make but one line upon the timbers; for the one interſects them in a direction perpendicular to the ſheer plane, and the other is ſo inclined as to interſect the timbers in the very ſame points. The horizontal one is too ſhort upon the plate, but the true length of it might eaſily be had by transferring to the ſheer plane the ſeveral heights at which the diagonal interſects the timbers in the body plane. By theſe we might form a height of breadth line to correſpond to this horizontal ribband, which is only a half breadth line; and the length of this height of breadth line may be taken by a penning batten, and all the timbers marked upon it. Now, when the batten is applied to a ſtraight line, and all the timbers transferred to this line from the batten, we may erect perpendiculars at each, and ſet off the ſame half breadths as before; by which means we may have the true length of the horizontal ribband: but, as this will be of no manner of ſervice, we ſhall omit forming it. We only mention it, becauſe ſeveral imagine theſe two curves to be as different

on the ſurface of the ſhip as they are upon the draught. The horizontal ribband corresponding to the firſt diagonal one is formed to timber 7, and marked 1ſt H R; but the horizontals for the ſecond and fourth diagonals were formed by a black-lead pencil, and only the point in which they interſect the line F P, is in the plate; which is ſufficient for our purpoſe.

There are likewiſe five water lines formed, four of which are repreſented by level lines in the body plane, and by lines parallel to the keel in the ſheer plane: three of them repreſent the planes of the tranſoms in the ſheer plane, viz. D^k. 1st, 2^d: but the plane of the third tranſom is perpendicular to the poſt. The lower water line is drawn parallel to the keel from the ſtem to the poſt, and produced into the body plane, as in the plate, where it is marked M N: the plane of the third tranſom interſects the timbers at different heights, which are transferred from the ſheer to the body plane, where it forms a curve.

The water lines being now drawn in the ſheer and body plane, our next buſineſs is to form them in the floor plane, where they will be curves. The points through which the curve of the lower water line is to paſs, are had by transferring the ſeveral portions of the level line, intercepted between the line K O, and the curve of each timber, from the body plane to the correſponding perpendiculars in the floor plane, where it is marked *Wat^r* L. It muſt be obſerved that the line K O, in the body plane, repreſents the ſeveral perpendiculars that are drawn in the ſheer plane to repreſent the planes of the timbers: for the ſpaces in the body plane, contained between the line K O and the curves of each timber, are ſo many different planes; and, when in their proper places, they will be parallel to one another, if perpendicular to the ſheer and floor planes. Thus the plane contained between the line K O, and the curve of timber ⊕ is (when in its proper place) ſuppoſed to be erected perpendicular to the ſheer plane, in the line which repreſents the plane of ⊕; and the like may be ſaid of all the reſt. The planes of the cant timbers will not be parallel to one another, becauſe they are differently inclined to the ſheer plane; but, as they are perpendicular to the floor plane, they will interſect the ſheer plane in a line perpendicular to the keel: ſo the plane of the faſhion piece interſects the ſheer plane in the dotted perpendicular, erected from the point F, which is the ſame with the line K O, in the body plane. We thought it neceſſary to take notice of this, becauſe ſome who are learning to draw, miſtake the line K O; for they imagine it only repreſents the poſt or ſtem.

Another error which they frequently fall into, is about forming the water lines when their planes are not parallel to the keel. They imagine that the half breadths muſt be ſet off from the line W K, which repreſents the lower edge of the keel; whereas it is indifferent what ſtraight line they are ſet off from, ſo the timbers be exactly ſpaced, and perpendiculars drawn to repreſent their planes. Now, when the water lines are ſuppoſed parallel to the keel, the timbers are properly ſpaced, and the perpendiculars ready drawn to the line W K; which is the reaſon it is uſed in ſuch caſes: tho' when the plane is in its true place, the line W K will be in the line M N. But the caſe will be quite different when the water lines are not parallel to the keel; for then their planes will interſect the ſheer plane in a ſtraight line, forming oblique angles with the planes of the timbers; this is the caſe in the plane of the third tranſom. The diſtances between the timbers will be more in this line than in the line W K; ſo the half breadths cannot be ſet off from the line W K, upon the perpendiculars that repreſent the planes of the timbers, unleſs they be properly ſpaced at the ſame diſtance they are upon the line that repreſents the plane of the third tranſom in the ſheer plane; upon which account we have made uſe of that line to ſet off the half breadths from, and drawn the dotted perpendiculars at the points where it interſects the planes of the timbers 8, 7, and at the point where it interſects the lower height of the breadth line. The heights of the points of interſection are transferred from the ſheer to the body plane; and the half breadths, at theſe heights, transferred from the body plane to the dotted perpendiculars before drawn: the half breadth to be ſet off upon the perpendicular where it interſects the lower height of the breadth line, is had from the floor plane, and the dotted perpendicular *a a* will ſhew the place where the half breadth muſt be taken: this perpendicular, if produced, will interſect the plane of the third tranſom in the lower height of the breadth.

Having now formed four diagonal ribbands with their correſponding horizontals, and alſo two water lines; we may by theſe form the faſhion piece, either upon the body plane or ſheer plane; but, as the plane of the faſhion piece is parallel to neither of theſe, it will require two operations.

Now the line F P will interſect all the ribband and water lines; but, becauſe the diagonal ribbands are not in their proper poſition, the line F P will not interſect them in the point where the plane of the faſhion piece interſects them.

The firſt thing then to be done, is to find the true place of the faſhion piece on each diagonal ribband: and firſt, to find its place upon the fourth diagonal ribband, from the point *t*, where the fourth horizontal ribband interſects the line F P, let fall a perpendicular to the point *s*, and produce it to interſect the diagonal ribband in *r*; ſo ſhall *r* be the true place of the faſhion piece upon that ribband; that part of the perpendicular between *t* and *s* is not drawn in the plate, to avoid the confuſion of too many lines. The reaſon of this will be very evident, if we ſuppoſe the whole plane of the ribband to be turned round upon the axis W K; for then the point *r* will always be right over ſome point of the perpendicular *r t s*; and, when the ribband is in its proper inclination, a perpendicular from *r* will fall into the point *t*, and the plane of the faſhion piece will interſect the floor plane in the line *t* F, and the plane of the diagonal ribband in a ſtraight line drawn from *r* to F: for it muſt be obſerved, that when the ribband is in its proper place, the line W K will be in the ſheer plane, in a line parallel to the keel; the height of which may be had from the body plane. In this caſe it will be the diſtance between K and *r*, but it will be needleſs to draw this line in the plate.

Having now found the place of the faſhion piece on the fourth diagonal ribband, we muſt by the ſame method find its place on the other diagonals, as in the plate, where lines perpendicular to W K are drawn to the points *o*, *o*, *o*, in the diagonal ribbands, from the points where the line F P interſects the correſponding horizontal ribbands.

Theſe points being now found, we may take the neareſt diſtance of each point to the line W K, and ſet off thoſe diſtances on the proper diagonals in the body plane. Thus, for the fourth ribband, place one foot of the compaſſes in the point *r*, and the other in the point *s* in the floor plane; and ſet off that diſtance from *r* to S, on the fourth diagonal in the body plane: do the ſame by all the reſt of the diagonals; and a curve interſecting the diagonals in theſe points would be the projection of the faſhion piece in the body plane, but we have not drawn this in the plate; for, as the plane of the faſhion piece is not parallel to that of the body plane, its projection will be leſs than the original: however, this may be found by the following method:

Firſt, draw a perpendicular to the line K O, in the body plane, to paſs through the point S to F.

Second, take the diſtance from *r* to F, in the floor plane, and ſet it off from *r* to F, in the body plane. In like manner draw perpendiculars to the line K O, in the body plane, through the points before found on the diagonals, as in the plate, where only that part of the perpendicular is drawn which lies without the diagonal; and take the ſeveral diſtances between the points *o* and F, in the floor plane, and ſet them off from the interſections of their correſponding diagonals, with the line K O, to the points *o*, *o*, in the body plane: ſo we have the points *o*, *o*, F, through which the curve muſt paſs.

Thirdly, to find the point P in the body plane, thro' which the curve muſt paſs, transfer the point P in the floor plane, to the point P, in the ſheer plane, by a perpendicular to the line W K, to interſect the height of breadth line in the point P; and ſet off this height upon the line K O, in the body plane, which will be a little above W, the height of the wing tranſom: draw a perpendicular at this point, to the line K O, take the line F P, in the floor plane, and ſet it off upon this perpendicular,

from

from the line K O, to the point P: ſo ſhall the curve P F *o o* be the form of the faſhion piece.

Theſe points may all be found without the diagonal ribbands, by half breadth lines and water lines, formed on the floor plane; as, for inſtance, to find the point F, place one foot of the compaſſes in *t*, the point where the horizontal ribband interſects the plane of the faſhion piece, and the other in *s*; *t s* being perpendicular to W K: with that extent, move the compaſſes with one point in the line K O, and the other point perpendicular to it, till it interſect the fourth diagonal, in the point S; through which draw the perpendicular *t* F. Then take the diſtance from *t* to F, in the floor plane, which ſet off from *t* to F in the body plane; ſo ſhall F be the point required, as before: in like manner the points *o o*, may be found: but this, as well as the other method, requires two operations; whereas, if ſeveral water lines were formed, with their planes parallel to the keel, we might find the points by one operation.

Thus, ſuppoſe it was required to find a point in the level line, that repreſents the plane of the water line formed in the floor plane, which is marked *Wat*r L, fix one foot of the compaſſes in the point *f*, where the line F P interſects the water line in the floor plane, and the other foot in the point F. Set off this upon the level line in the body plane, from the line K O to *f*, which will be the point required. All the other cant timbers, both in the fore and after body, are formed after the ſame manner as the faſhion piece. We have formed but one more in the plate, which is abaft the faſhion piece, to aſſiſt us in forming the tranſoms.

The tranſoms are faſtened to the ſtern poſt, in the ſame manner that the floor timbers are to the keel; and, as the floor timbers have a riſing, ſo likewiſe have the tranſoms, which is called the flight; and beſides this flight, the wing tranſom has a round aft, and a round up, both which are arbitrary: the deck tranſom has a round up, the ſame with that of the beams: but, in forming the tranſoms, there is no regard had to the round up; for that may be done by the beam mould, after the tranſom is properly hewed the moulding way.

In forming the tranſoms, the firſt thing to be done, is to aſſign each its proper place upon the poſt, and then to determine the poſition of their planes with reſpect to the floor plane; for their planes are always perpendicular to the ſheer plane. In the plate there are five tranſoms: their upper ſides upon the poſt are in the points W, D^k. 1^ſt, 2^d, 3^d: the planes of the wing, deck, firſt and ſecond tranſoms, are ſuppoſed parallel to the floor plane, and repreſented in the ſheer plane by lines drawn parallel to the keel from the poſt, till they interſect the lower height of the breadth line; and the plane of the third is repreſented by a line perpendicular to the poſt, as in the plate. So it will not be parallel to the floor plane.

The height and poſition of the tranſoms being determined, we have no more to do, but to form water lines for each. That for the third we have already formed: the reſt, being ſuppoſed parallel to the floor plane, may be formed in the ſame manner as the water line there laid down: the only difficulty will be to find a ſufficient number of points to determine their forms; becauſe, in the deck and firſt tranſoms, their planes interſect the breadth; ſo that we could only have a point in timber 8, if the faſhion piece and a timber abaft it had not been formed by the ribbands; but, now they are formed, we may have likewiſe a point in each of their planes, thro' which the curves of the water lines ſhall paſs.

We ſhall begin with the wing tranſom. Firſt, determine the round aft, which ſuppoſe the line W T, in the floor plane: take its height from the ſheer plane, and ſet it up in the body plane from K to W, and draw the line W T: then take this line W T, and ſet it off on the floor plane, on the line F P, which will reach to the point *n*. A curve drawn through the point *n*, to break in fair with the breadth line, as in the plate, will interſect the line W T in T; ſo ſhall W T *n* be the aft ſide of the wing tranſom. Next, for the deck tranſom, draw a level line in the body plane at the point D to timber 8. Set off this diſtance upon timber 8, in the floor plane, from the line W K; which will give us a point through which the curve muſt paſs; then take the diſtance in the level line, between the line K O and the curve of the faſhion piece: which ſet off from the point F, upon the line F P in the floor plane; and this will give another point thro' which the curve muſt paſs: again, take the diſtance in the ſame level line, between the line K O and the curve of the timber abaft the faſhion piece; which ſet off from the point G upon the line G *g*, in the floor plane; and we ſhall have a third point through which the curve muſt paſs. Laſtly, let fall a perpendicular to the line W K, from the point D^k upon the poſt, and produce it into the floor plane, upon which ſet off half the thickneſs of the poſt, allowing for the rabbet, which will limit the end of the water line that forms the deck tranſom. After the ſame manner are the firſt and ſecond tranſoms formed, by drawing level lines in the body plane, at their heights upon the line K O.

Now ſome are apt to miſtake theſe level lines for the lengths of the tranſoms: the reaſon, as was before obſerved, is becauſe they imagine the line K O to be the ſtern poſt; whereas it is the perpendicular in which the plane of the faſhion piece interſects the ſheer plane; and ſo theſe lines are drawn upon the plane of the faſhion piece.

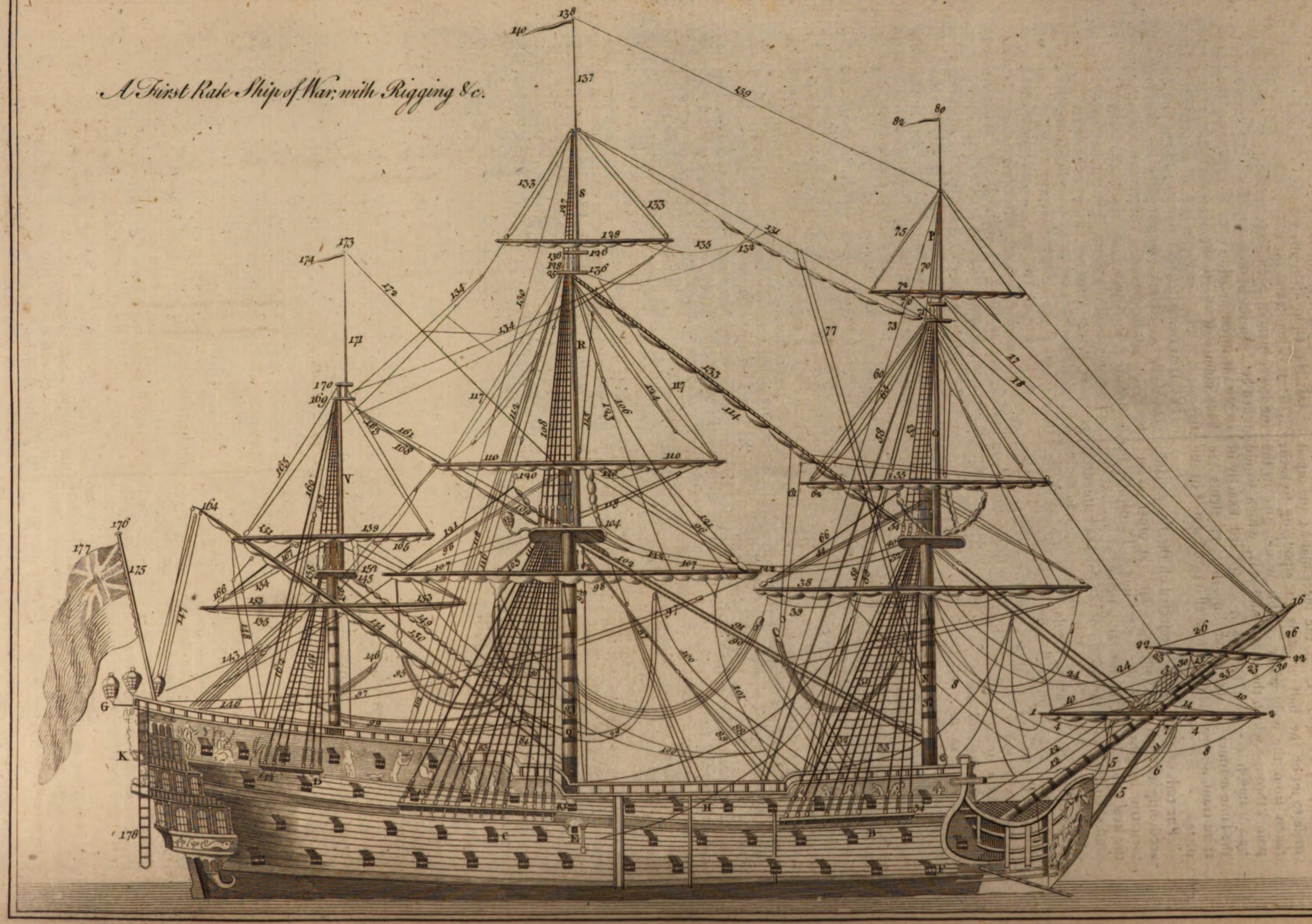
All that now remains, is to determine the length of each tranſom; and this is done by the line F P, in the floor plane, which interſects the wing, deck, firſt and ſecond tranſoms, to their proper lengths. But, before we can find the length of the third, the plane of the faſhion piece muſt be projected upon the ſheer plane: thus, take the neareſt diſtance between any perpendicular in the floor plane, and the point where the line F P interſects the water line; and ſet that off from the ſame perpendicular upon the line that repreſents the ſame water line in the ſheer plane. Now the curve P F will be found to be the projection of the aft ſide of the faſhion piece upon the ſheer plane: for the diſtance between the perpendicular of timber 8, and the point *f*, where the line F P interſects the lower water line in the floor plane, is equal to the diſtance between the ſame perpendicular and the curve P F, taken in the line M N. The diſtance between the perpendicular of timber 8, and the point where the line F P interſects the ſecond water line in the floor plane, is equal to the diſtance between the ſame perpendicular and the curve P F, taken in the line that repreſents the ſecond tranſom in the ſheer plane. And by the ſame method, we find points in the lines that repreſent the deck and firſt tranſoms. The point P is tranſferred from the half breadth line in the floor plane, to the height of the breadth line in the ſheer plane. The curve, being thus drawn, will interſect the line that repreſents the plane of the third tranſom, in the point z: from which point draw the perpendicular z F, to the curve of the dotted water line; ſo ſhall 3^d z, F, be the true form of the third tranſom: and a line drawn from F to P will be the plane of the faſhion piece. It muſt be obſerved that the ends of the tranſoms are let into the faſhion piece; for which there muſt be a proper allowance left without the lengths found by the line F P. We have in the plate only laid down the half of each tranſom. Thoſe who incline to lay down the whole tranſoms, may eaſily transfer the halfs already deſcribed to the other ſide of the line W F.

Having now formed all the timbers, both ſquare and cant, in the after body, we ſhall proceed to the fore body. The cant timbers are laid down in the ſame manner as thoſe in the after body, by the diagonal and horizontal ribbands; where the dotted line K T repreſents the plane of the knuckle timber, canted upon the floor plane; from whence it is transferred to the body plane, and repreſented by the dotted curve between the timber H and G.

The hawſe pieces are ſeldom laid down in the loft; it being the general practice to make moulds for them after the other timbers are put up, and the harpins are brought about.

As the harpins are levelled acroſs, they will be formed by the ſection of a plane perpendicular to the ſheer plane: but there is no neceſſity for theſe ſections to be parallel to the keel. In the plate we have drawn only a ſtraight line to repreſent the plane of the harpin above the wale. It is drawn from the ſtem to the timber E, and marked

A First Rate Ship of War, with Rigging &c.



harpin. Now, in order to form the curve of this harpin, it would be proper to form timber F, in the body plane: alſo to draw perpendiculars to the ſeveral points where the plane of the harpin interſects the planes of the timbers E, F, G, and H, in the ſheer plane; and upon theſe to ſet off the half breadths correſponding to each, taken from the body plane. This would give us the points through which the curve muſt paſs, which would be a water line. But, as this is performed exactly in the ſame manner as the water line that repreſents the third tranſom, we judge it unneceſſary to form it in the plate.

The rails of the head are projected on the ſheer plane, according to their true hangings: and, in order to find their true lengths, draw the dotted line S T, parallel to the keel at the height of the rails, upon the head. We muſt then determine the ſtation of the cat-head upon the floor plane; and likewiſe the thickneſs of the head at the rail; and let fall a perpendicular from the point T, where the line S T interſects the cat-head in the ſheer plane, to the point T in the floor plane; and likewiſe a perpendicular from S in the ſheer, to S in the floor plane; and draw the line T S: S S, in the floor plane, being half the thickneſs of the head of the figure at the rail; ſo ſhall T S, in the floor plane, be the true length of the rail. Let the line T S, in the ſheer plane, be divided into any number of equal parts: ſuppoſe into the points *x*, *y*, *z*; from which points draw perpendiculars to the line T S, to be limited by the rail. Divide the line T S, in the floor plane, into the ſame number of equal parts, in the points *x*, *y*, *z*. Draw perpendiculars to theſe points, and make them equal to the correſponding ones in the ſheer plane; ſo we ſhall have the points through which the curve of the rail muſt paſs.

We have now ſhewn different ways of forming all the timbers; where it muſt be obſerved, that we have always ſuppoſed every timber to be one intire piece of wood from the keel to the top of the ſide; whereas, in reality, they are in ſeveral different pieces; the head of the lower piece being cut ſquare to join to the heel of the next above it: and, in order to ſupport theſe joinings, another ſet of pieces are cut, and joined together in ſuch a manner, that, if both the ſets were faſtened together, the joinings in one ſet would be nearly againſt the middle of the pieces in the other ſet. In this manner are all the frames faſtened and erected, as if each was one piece of wood.

The pieces laid acroſs the keel, to which they are faſtened, are called floor timbers: the other pieces are called futtocks, except that which goes to the top of the ſide, which is called a top timber. Hence it is plain that the mould which ſerves for the floor timber, will ſerve for the lower part of the correſponding futtock. The mould for the upper part of the firſt futtock will be the ſame with that for the lower part of the ſecond; and the mould for the lower part of the top timber will be the ſame with that of the upper part of the correſponding futtock. It is alſo of great importance, in building, to give proper ſcarphs to the timbers. *Murray on Shipbuilding.*

SHIPWRIGHT'S *Sector*, the name of an inſtrument, invented by Mr. Mungo Murray, for forming the plane of a ſhip called the body.

This ſector has ſeven lines on each leg, meeting at the center of the joint, numbered I, II, III, IV, &c. ſo that every line upon one leg has a correſponding one upon the other, both divided and numbered alike. The after body is upon one ſide, and the fore body on the other.

The lines for the after body are as follows. See plate CXVIII. *fig.* 1.

I. Has five diviſions, viz. ⊕, 4, 1ſt dl, 8, ſt^{n}; and marked at the end H B T^{r}, denoting the height of the top timber breadth line at four timbers; ſt^{n} is the ſtern timber, and 1ſt dl, the firſt diagonal in the body plane.

II. Has eight diviſions, viz. $\frac{L\ C,}{U,\ A,}$ $\frac{U^{r}\ C^{s},}{A,\ U,}$ St^{n}, 8, 4, ⊕, and marked at the end ½ B T^{r}, denoting the half breadth of the top timber at three timbers. L^{r} C^{r} ſignifies the lower counter, and U^{r} C^{r} the upper counter; U denotes the height, and A the rake of the counters, both taken from the wing tranſom; St^{n} is the rake of the ſtern timber, which is likewiſe taken from the wing tranſom at the height of the ſheer rail.

III. Has eight diviſions, viz. dst, u^{r} S. R *i s*, ⊕, 3, 5, 7, 8: it is marked at the end L H B, for the height of the lower breadth line for five timbers: *d*st is for the diſtance between the frames, and R *i s*, for the diſtance between the lower breadth line, and the dead riſing in the body plane: u^{r} S. is the radius of the upper breadth ſweep.

IV. Is in two parts. The innermoſt has four diviſions, viz. 7, 5, 3, ⊕, expreſſing the points where theſe timbers interſect the ſecond diagonal in the body plane: it is marked at the end 2 R for the ſecond ribband.

The outermoſt part has ſix diviſions, viz, ⊕, 3, 5, 7, 8, W T, and marked at the end U H B for the height of the upper breadth line at five timbers, and at the wing tranſom denoted by W T.

V. Is likewiſe in two parts. The innermoſt has four diviſions, viz. 7, 5, 3, ⊕, expreſſing the points where theſe timbers interſect the firſt diagonal: it is marked 1st R, for the firſt ribband.

The outermoſt part has eight diviſions, viz. T, 8, 7, 5, 3, ⊕, *k l*, and then marked M ½ Bth, for the main half breadth of five timbers; T for that at the wing tranſom, and *k l* for the half breadth of the keel in midſhips; without which there is another diviſion marked 3^{d} dl for the third diagonal.

VI. Has four diviſions, viz, 7, 5, 3, ⊕, for the points where thoſe timbers interſect the third diagonal: it is marked 3d R, denoting the third ribband; without which there is another diviſion marked 2d dl, for the ſecond diagonal.

VII. Has five diviſions, viz. 7, ½ B F l, 5, 3, ⊕. ½ B F l, denotes the half breadth of the floor: the other four are for the points where thoſe timbers interſect the fourth diagonal: it is marked 4th R, denoting the fourth ribband; without which there is another diviſion for the rake of the poſt marked R^{k} P.

The height of the gun-deck is between N°. IV. and V. G D ⊕ for that in midſhips, and G D *a* for that at the poſt. There is likewiſe another diviſion between N°. I. and II. for the fourth diagonal: it is marked ½ 4th dl, which muſt be doubled, becauſe the length of the ſector will not contain the whole.

Index to the After Body.

		N°.
Height of the breadth,	lower	III.
	upper	IV.
	top timber	I.
riſing		N°. III.
Half breadth	main	V.
	top timber	II.
	floor	VII.
Counter and ſtern timber, height, and rake		II.
Rake of the poſt		VII.
Upper breadth ſweep		III.
Ribbands	1	N°. V.
	2	IV.
	3	VI.
	4	VII.
Diagonals	1	I.
	2	VI.
	3	V.
	4	between I. and II.
Diſtance between the frames		III.

The Lines for the Fore Body are.

I. Has three diviſions, viz. H^{t} ſtem, $\frac{G^{d},\ H^{d}}{\text{rake } f^{r}\ G}$ denoting the height of the ſtem; and its rake from timber G at the gun-deck and head.

II. Has four diviſions, viz. *d*, *h*, and theſe marked H^{r} T^{r}, for the height of the top timber line at theſe timbers; and again *d*, *h*, for the ½ breadth of thoſe timbers; and the line marked ½ B T R.

III. Has four diviſions, viz. d^{t} F for the diſtance between the frames, and *e*, *e*, *g*; it is marked L H B, denoting

noting the height of the lower breadth line at these timbers.

IV. Is in two parts. The innermost has four divisions, viz. *g*, *e*, *c*, ⊕, for the points of intersection of these timbers with the second diagonal: it is marked 2[d] R for the second ribband.

The outermost part has three divisions, viz. *c*, *e*, *g*: it is marked U H B, denoting the height of the upper breadth line at these timbers.

V. Is in two parts. The innermost has four divisions, viz. *g*, *e*. *c*, ⊕, for the points of intersection of these timbers with the first diagonal: it is marked 1st R for the first ribband.

The outermost part has four divisions, viz. *g*, *e*, *c*, ⊕: it is marked M ½ B[th], for the main half breadth at these timbers.

VI. Has four divisions, viz. *g*. *e*, *c*, ⊕, for the points of intersection of these timbers with the third diagonal: it is marked 3[d] R, for the third ribband.

VII. Has four divisions, viz. *g*, *e*, *c*, ⊕, for the points of intersection of these timbers with the fourth diagonal: it is marked 4th R for the fourth ribband. The sweep of the stem is between N°. III. and IV; and the height of the gun-deck between IV and V.

Index to the Fore Body.

		N°.
Height of breadth	lower	III.
	upper	IV.
	top timber	II.
Half breadth	main	V.
	top timber	II.
Stem height and rake		I.
		N°.
Ribbands	1	V.
	2	IV.
	3	VI.
	4	VII.
Distance of frames		III.

Sweep of the stern between III and V.

The use of this instrument we have already given under the preceding article. *Murray's Treatise on Shipbuilding.*

SHIRE, the same with county, a division, or portion of the kingdom.

SHIVERY *Salt*, a name given by the salt workers to a sort of salt very different from the common brine salt, and formed among the common sort in the boiling pan.

SHOAD, in mining, a train of metalline stones mixed with earth, lying sometimes near the surface, and sometimes at considerable depths; but always affords a sure indication to the miner, that the load or vein of ore is not far distant. The deeper the shoad lies, the nearer generally the vein is.

SHOAD-STONES, a name given by the Cornish miners to those loose masses of stone usually found about the entrance of mines; and sometimes running from the load or vein of ore to the surface of the earth.

SHOAL, in the sea language, denotes a place where the water is shallow.

SHOALED, among tin-miners, signifies fragments of ore, which by rains, currents of water, &c. are torn from the load or vein of ore.

SHOAR, or SHORE. See the article SHORE.

SHOE, *Calceus*, a covering for the foot, usually made of leather.

Horse-SHOES. See HORSE.

SHORE, or SHOAR, a place washed by the sea, or by some large river.

Count Marsigli divides the sea-shore into three portions; the first of which is that tract of land which the sea just reaches in storms and high tides, but which it never covers; the second part of the shore, is that which is covered in high tides and storms, but is dry at other times; and the third is the descent from this, which is always covered with water.

The first part is only a continuation of the continent, and suffers no alteration from the neighbourhood of the sea, except that it is rendered fit for the growth of some plants, and wholly unfit for that of others, by the saline steams and impregnations: and it is scarce to be conceived by any, but those who have observed it, how far on land the effects of the sea reach, so as to make the earth proper for plants, which will not grow without this influence; there being several plants frequently found on high hills and dry places, at three, four, and more miles from the sea, which yet would not grow, unless in the neighbourhood of it, nor will ever be found elsewhere.

The second part or portion of the shore is much more affected by the sea than the former, being frequently washed and beaten by it. Its productions are rendered salt by the water, and is covered with sand, or with the fragments of shells in form of sand, and in some places with a tartarous matter deposited from the water; the colour of this whole extent of ground is usually dusky and dull, especially where there are rocks and stones, and these covered with a slimy matter.

The third part of the shore is more affected by the sea than either of the others, and is covered with an uniform crust of the true nature of the bottom of the sea, except that plants and animals have their residence in it; and the decayed parts of these alter it a little.

SHORT ACCENT, in grammar, a mark which shews, that the syllable over which it is placed is short. It is marked thus (˘).

SHORT-SIGHTEDNESS, *Myopia*, in surgery. See the article MYOPIA.

SHOT, in military affairs, includes all kinds of balls or bullets, for fire-arms.

Trundle SHOT, an iron-shot, about seventeen inches long, and sharp-pointed at both ends, with a ball of lead fastened upon it, about a hand-breadth from each end.

SHOULDER BONE, *humerus*, in surgery. See HUMERUS.

SHOULDER-BLADE, *scapula*. See the article SCAPULA.

SHOULDER-PITCH, among farriers, a disease in a horse, when the pitch or point of the shoulder is displaced.

SHOULDER-SPLAIT, a hurt which a horse receives from some dangerous slip, whereby the shoulder is parted from the breast.

SHOULDERING PIECE, among builders, the same with a bracket. See BRACKET.

SHOWER, a cloud resolved into rain, and discharged upon a certain tract of ground. See the article RAIN.

SHREW-MOUSE, or *Hardy* SHREW, in zoology, a genus of quadrupeds, of the order of the glires; the upper fore-teeth of which are fifid, and lower ones serrated: the upper canine teeth are very small, and four in number.

The shrew-mouse is an extremely singular little animal, which greatly resembles the common mouse, but is somewhat smaller.

SHRIMP, in ichthyology, the English name of two different species of the squilla, viz. the common shrimp, and the smooth nosed shrimp.

The common shrimp is the long-tailed squilla, with the snout serrated above and tridentated below; the body is oblong and rounded above the beak or snout; which distinguishes it from all the other species: it is long, of a lanceolated figure, sharp-pointed, and has eight denticulations above and three below. The smooth nosed shrimp, or long-tailed squilla, with a smooth snout, grows to the same size with the common shrimp; however, the body is thick, and the snout is very short, without the spines or denticulations of the other.

SHRINE, in ecclesiastical history, a case to hold the relics of some saint.

The word is formed from the Latin, *scrinium*, a desk or cabinet.

SHROVE-TUESDAY, in the Christian church, is the Tuesday after Quinquagesima Sunday. It is so called from the old Saxon word *shrive*, which signifies to confess: it having been a custom formerly in the Romish church, to confess their sins on that day, in order to receive the eucharist, and thereby qualify themselves for a more religious observation of Lent.

In process of time, this custom was changed into that of mutual invitations, in order to take leave of flesh-meat

and other dainties; and this made way for ſports and other merriments, which at preſent make up the whole buſineſs of the carnival, or ſeaſon immediately preceding Lent.

SHROWDING *of Trees*, the cutting or lopping off the top branches; it is only practiſed on thoſe trees which are deſigned for fuel, or ſome preſent uſe, not being fit for timber.

SHRUB, *Frutex*, a woody plant, of a ſize leſs than a tree, and which, beſides its principal ſtem and branches, frequently from the ſame root, puts forth ſeveral other conſiderable ſets or ſtems.

SHUTTLE, in the manufactures, an inſtrument uſed by the weavers, which with the thread it contains, either of woolen, ſilk, flax, or other matters, ſerves to form the woofs of ſtuffs, cloths, linens, ribbands, &c. by throwing the ſhuttle alternately from right to left, and from left to right, acroſs between the threads of the warp, which are ſtretched out lengthwiſe on the loom.

SI, in muſic, a ſeventh note lately added by Le Maire to the ſix ancient notes invented by Guido Aretin, by means of which the difficulty attending the ancient ſcale is avoided.

SIBERIA, or ASIATIC RUSSIA, the moſt northern country of Aſia, ſituated between the ſixtieth and one hundred and thirtieth degree eaſt longitude, and between the forty-ſeventh and ſeventy-ſecond degree north latitude; being upwards of two thouſand miles in length from eaſt to weſt, and one thouſand five hundred miles in breadth from north to ſouth. We include the Calmuc Tartars within the limits of Siberia, as they acknowledge themſelves ſubject to the empire of Ruſſia.

SIBYLS, *Sibyllæ*, in pagan antiquity, certain women, ſaid to have been endued with a prophetic ſpirit, and to have delivered oracles fore-ſhowing the fates and revolutions of kingdoms. We have in the writings of the ancients mention made of ten of them, the eldeſt of whom being named Sibylla, all the reſt of the ſame ſex, who afterwards pretended to the like fatidical ſpirit, were called from her Sibyls. The moſt eminent of the ten, mentioned in hiſtory, was ſhe, whom the Romans called Sibylla Cumæa or Erythræa. She was born at Erythræ in Ionia, from whence ſhe removed to Cumæ in Italy, and there delivered all her oracles from a cave or ſubterraneous vault dug out of the main rock.

Juſtin Martyr, who had been upon the place, ſpeaking of it, and the Sibyl, tells us, it was reported, that this Sibyl was a Babylonian by deſcent, and the daughter of Beroſus, who wrote the Chaldaic hiſtory: but how ſhe came into Italy, no one could tell. As to the cave, where ſhe delivered her oracles, he tells us, it was a kind of chapel, or oratory, hewn out of the main rock. Here he was ſhewn three hollow places, in which ſhe uſed to waſh herſelf, and a high advanced ſeat, from which, they pretended, ſhe delivered her oracles. This place continued to be ſeen many hundred years after, till the year 1539, when a violent earthquake utterly deſtroyed this chapel of the Cumæan Sibyl. But travellers are ſtill ſhewn a vault, which they call the Grotto of the Sibyl to this day.

The Sibylline oracles, of which we hear ſo much in the Roman hiſtory, had their origin as follows. In the reign of Tarquin the ſecond, a certain woman came to Rome, and brought with her nine books of oracles, which ſhe offered to the king, demanding for them three hundred pieces of gold. Tarquin refuſing to give her that price for them, ſhe burnt three of the nine, and then offered him the remaining ſix at the ſame price. Being again rejected by the king, who thought her mad, ſhe burnt three more of them, and then offering him the remaining three, perſiſted in demanding the ſame price for theſe, as ſhe did at firſt for all the nine. At which ſtrange procedure Tarquin being moved, conſulted the augurs thereupon, who earneſtly adviſed him to purchaſe the books. Hereupon the money being paid, and the books delivered to the king, the woman gave him ſtrict charge to keep them ſafely, as containing oracles relating to the future ſtate of Rome: after which ſhe diſappeared, and was never more ſeen. Tarquin, putting theſe books into a ſtone coffin, laid them up in a vault under the Temple of Jupiter Capitolinus, and appointed two of the principal nobility to keep them, with ſtrict orders to let no one peruſe them.

After the diſſolution of the regal power, the commonwealth made theſe books a main engine of ſtate, for quieting the people in all diſturbances. For, whenever any great misfortune befel them, or any prodigies affrighted them, theſe books were ordered to be conſulted, and the keepers of them always reported ſuch anſwers as ſerved the purpoſes of the government. Theſe guardians of the Sibylline books were at firſt but two, and were then called Duumviri: afterwards they were increaſed to ten, and were then called Decemviri: laſtly, their number was augmented to fifteen, and then they had the name of Quindecemviri. They were always choſen out of the Patrician families, and held the office for life, being exempted from all burthens of the ſtate both civil and military.

Theſe books were carefully kept, till the civil wars of Sylla and Marius; when the Capitol being accidentally ſet on fire, and burnt down to the ground, the Sibylline oracles were burnt with it. This was eighty-three years before Chriſt. Seven years after, the Capitol being rebuilt, the ſenate reſolved, if poſſible, to reſtore theſe oracles. Accordingly they ſent embaſſadors to Erythræ in Ionia, where the Cumæan Sibyl was born, and where many of that Sibyl's oracles were ſaid to be preſerved, to take copies of as many as they could find. Theſe deputies, having collected together, from the papers of ſeveral private perſons, about a thouſand verſes in the Greek language, pretended to be the prophecies of this and other Sibyls, brought them to Rome; and at the ſame time enquiry being alſo made at Samos, Ilium, and other cities in Greece, Sicily, Africa, and Italy, for the like oracles and prophecies of the Sibyls, great numbers that pretended to be ſuch were gathered together, and laid up in the Capitol, to ſupply the place of thoſe that were burnt. But the uſe which the Romans propoſed to make of theſe oracles, being much defeated by their being vulgarly known, and in the hands of many perſons, a law was made that all who had any copies of them, ſhould bring them in to the pretor of the city, and all were prohibited under pain of death to retain them. Notwithſtanding this, many, that had tranſcripts of theſe oracles, ſtill kept them privately in their hands, and their number increaſed daily. For this reaſon, Auguſtus, when he took upon him the high-prieſthood, revived the abovementioned law: whereupon ſo many copies of theſe pretended prophecies being brought in, as amounted to a great multitude of volumes, he ordered them to be ſtrictly examined, and having burnt and deſtroyed all that were diſapproved, repoſited the reſt for the uſe of the ſtate. Theſe afterwards Tiberius cauſed to be re-examined, and burnt many more of them, preſerving only ſuch as were of moment, and uſeful to the ſtate.

To theſe Sibylline oracles, as long as Rome continued heathen, great recourſe was had; and they remained in uſe to the year of our Lord 399, when they were utterly deſtroyed. For, not long before that time, a prophecy being given out by the heathen Romans, pretended to be taken from the Sibylline writings, which imported that Peter having by magic founded the Chriſtian religion to laſt for the term of 365 years only, it was at the end of this time wholly to vaniſh, and be no more profeſſed in the world, and this term expiring in the year of our Lord 398; Honorius the Roman emperor, taking the advantage hereof to convict theſe writings of manifeſt forgery and impoſture, ordered them all to be deſtroyed; and accordingly, the next year, Stilico, by virtue of the imperial decree, burnt the Sibylline books, and demoliſhed the temple of Apollo, in which they were repoſited.

It was out of the Sibylline books that Virgil took that famous prophecy, which makes the ſubject of his fourth Eclogue. This prophecy the poet, with fine addreſs, applies to the birth of the ſon of Pollio: but the ancient Chriſtian writers generally underſtood it to be a direct prediction of the coming of the Meſſiah. And it was from the ſame ſource, that Suetonius derived what he ſays, "That in the time of Veſpaſian a conſtant and general

neral opinion prevailed throughout the whole East, that fate had decreed, that about that time ſhould come forth out of Judea thoſe who ſhould obtain the empire of the world." Which prediction is likewiſe aſcribed by the Chriſtian writers to the birth of Chriſt, and the propagation of his religion over the whole world. Thus the Sibyls are ſuppoſed to have foretold the Meſſiah, and the eſtabliſhment of the Chriſtian religion.

Joſephus the hiſtorian quotes, in his hiſtory, a paſſage from the Sibyls, which mentions the deluge. Clemens Alexandrinus aſſures us, that St. Paul in his preaching, often quoted the Sibylline books, and referred the Gentiles to them. And the ancient fathers of the church, as Juſtin Martyr, Athenagoras, Theophilus of Antioch, Tertullian, Lactantius, Euſebius, St. Jerom, St. Auſtin, and others, made good uſe of them againſt the pagans; which occaſioned theſe writers to be diſtinguiſhed by the name of Sibylliſts.

There is ſtill preſerved, in eight books of Greek verſes, a collection of oracles pretended to be the Sibylline. This collection muſt have been made after the year 138, becauſe mention is made in it of the emperor Antoninus Pius; and before 167, becauſe Juſtin Martyr ſeveral times quotes it. But whether this was a true collection of the Sibylline oracles, or a forgery occaſioned by the pious fraud of ſome over-zealous Chriſtian of thoſe times, is a queſtion among learned men. The generality of the critics look upon it as ſpurious, becauſe it contains ſuch an abſtract of the doctrines of the Old and New Teſtament, as none but a Chriſtian could write. Beſides which, it carries ſeveral other marks of impoſture; ſuch as the notion of the Millenarians, which was not broached till the ſecond century; and a ſucceſſion of all the Roman emperors from Julius Cæſar to Antoninus Pius, in ſuch a manner as ſhews it to have been written rather as a hiſtory of things paſt, than as a prophecy of future events. The learned author of the Connection of the Old and New Teſtament has ſifted this matter to the bottom, and given his opinion concerning the Sibyls and their books at large. The ſubſtance of what he ſays upon this ſubject is as follows.

1. Who, or how many the Sibyls were, or when, or where they lived, various authors, as to theſe particulars, write variouſly of them; and the moſt that they ſay concerning them is manifeſtly fable and fiction.

2. How muchſoever they might pretend to prophecy, they could not have it by divine inſpiration. For moſt of the oracles, that were produced from them, when conſulted by the Romans, directed to the moſt idolatrous and abominable rites, ſuch as human ſacrifices.

3. Therefore, if they had the gift of prophecy, they muſt have received it from diabolical or evil ſpirits. Or, the world being too fond of prophecies, they might take advantage of this weakneſs, to impoſe falſe pretences under this name. That ſome of them were found to be ſuch by the heathens themſelves, appears from hence, that Auguſtus burnt two thouſand volumes of theſe pretended oracles, and Tiberius many more of them.

4. The ſtory of the three books of the Sibyls ſold to Tarquin was, moſt probably, a ſtate-trick, or fetch of politics:

5. None being allowed to inſpect the Sibylline oracles, excepting only the ſacred college, the members of which were enabled thereby to counterfeit ſuch anſwers as beſt ſuited the exigencies of the government. Thus, when the Romans found it inconvenient for the ſtate, to reſtore Ptolemy Auletes to his kingdom, though they had engaged to do it, an oracle was produced out of the Sibylline books to forbid the thing.

6. The burning of the firſt Sibylline books, and the earneſt deſire of the ſenate to reſtore them, was a fruitful ſource of forgeries of this ſort.

7. The prophecies, which ſo plainly point out the coming of the Meſſiah, might come originally from the Jews themſelves. For it is well known, that the Jews, at the time of the deſtruction of Jeruſalem by the Romans, expected a temporal Meſſiah or deliverer. After the ruin of their city, being diſperſed among the heathens, and talking much about thoſe prophecies, which ſeemed to promiſe them ſuch a prince, theſe predictions might grow into reputation among the heathens, and be inſenſibly ingrafted among the oracles of the Sibyls, as if they had come from them. And God might permit this, that the coming of his Son might be foreſhewn to the heathens.

8. A collection being made of the Sibylline oracles, and by ſome Grecian digeſted into Greek verſes, about the time of our Saviour, and the abovementioned prophecies having been found therein, this operated much to the advantage of Chriſtianity in the earlieſt times. And this is the reaſon why the Chriſtian writers, in their diſputes with the Pagans, ſo often appeal to the Sibylline oracles.

SICYANIA, or GOURD-WORM, in natural hiſtory, a genus of inſects, being of an oblong form, flat on the belly, and rounded on the back; the ſkin is ſoft; and the mouth large, horizontal, and emarginated, or dented in the middle. It grows to two thirds of an inch in length, though more uſually it is not half that ſize; its breadth is nearly two thirds of its length.

SIDE, *Latus*, the half of any thing, as an animal, a ſhip, &c. The ſides of an animal are diſtinguiſhed into the right and left ſide; but thoſe of a ſhip, into the ſtarboard and larboard ſide.

In geometry, the ſides of a rectilinear figure are the lines which form its periphery.

SIDE *of a Power*, the ſame with its root. See the article ROOT.

SIDE-LAYS, among hunters, dogs that are let ſlip at deer, as he paſſes.

SIDES-MEN, or SYNOD'S MEN, perſons who, in large pariſhes, are appointed to aſſiſt the church-wardens in their enquiry and preſentments of ſuch offenders to the ordinary, as are puniſhable in the ſpiritual court.

SIDERATION, a term uſed for a ſphacelus or mortification.

Some alſo uſe the term ſideration for the blaſting or blighting of trees, plants, &c.

SIDEREAL YEAR. See YEAR.

SIDERITES, in natural hiſtory, the ſame with the magnet. See MAGNET.

SIDERITIS, Iron-wort, in botany, a genus of plants, with a monopetalous, labiated, and ringent flower; the ſeeds are four in number, and contained in the cup, which ſerves inſtead of a capſule; add to this, that the flowers grow in circles round the ſtalks, at the joinings of the leaves.

SIEGE, in the art of war, the encampment of an army round a place, in order to take it, either by formal attacks, or famine.

The word is French, and literally ſignifies a ſeat.

The method of encamping is very different in a ſiege, from that obſerved on a march; as in the former the army environs the place without cannon-ſhot, that nothing may enter. If the place be ſituated on a river, a detachment is ſent to the other ſide, and bridges of communication made both above and below the town. The army alſo encamp with their backs to the town, with the battalions and ſquadrons interlined; and, having taken poſſeſſion of all the heights, whence the enemy may be annoyed, the engineers trace the lines of circumvallation and contravallation, every regiment working at the place appointed them.

When the general has diſpoſed his guards, as well towards the place as towards the country, and eſtabliſhed the lieutenant-generals to command in the particular quarters, he goes with the engineers to view the place, and orders the attack in the place judged the weakeſt.

To form a ſiege, there muſt be an army ſufficient to furniſh five or ſix reliefs for the trenches, pioneers, guards, &c. alſo artillery, and magazines furniſhed with a ſufficient quantity of ammunition and proviſions; and an hoſpital, for taking care of the wounded.

To raiſe a ſiege, is to give over attacking a place; ordering the works and poſts before it to be levelled.

SIEUR, a title of reſpect among the French, like *maſter* among us: it is much uſed by the lawyers, as alſo by ſuperiors in their letters to inferiors.

SIGATI-GUSH, in zoology, the name of a Perſian animal, of the lynx kind, and no way differing from the lynx itſelf, but in that it has no ſpots. Its ears have the

fine velvety black pencil of hairs at their top, which are the diſtinguiſhing character of the lynx; and theſe creatures differ ſo much in the variations and different diſpoſitions of their ſpots, that probably this is no other than an accidental variety of the ſame ſpecies.

SIGHT, or VISION, in optics. See EYE and VISION.

SIGHTS, in mathematics, imply two thin pieces of braſs, &c. placed perpendicularly on the two extremities of the index of a theodolite, circumferentor, &c. each of which has an aperture or ſlit in the middle, through which the viſual rays paſs to the eye, and diſtant objects are ſeen.

SIGILLATA TERRA, a name given to ſeveral earths or boles, to ſignify their being genuine; the principal is that dug in the iſland Lemnos.

SIGMOIDES, a word uſed by medicinal writers to expreſs any thing that is in the ſhape of the letter ſigma. The valves of the heart have this epithet applied to them: the coracoide proceſs of the ſcapula is alſo expreſſed by the ſame word; the ſemicircular cavity of the cubit, at the articulation of the fore-arm with the humerus, is ſometimes alſo called the ſigmoidal cavity; and the cartilages of the ſigmoide circles of the aſpera arteria, or wind-pipe, have their denomination from the ſame occaſions.

SIGN, a ſenſible mark or character, denoting ſomething abſent or inviſible.

SIGN, in algebra. See CHARACTER.

SIGN, in medicine, implies ſome appearance in the body, diſtinguiſhable by the ſenſes, whence, by juſt reaſoning, is inferred the preſence, nature, ſtate, event of health, a diſeaſe, or death.

Thoſe which indicate the preſent condition of a body, whether ſick or well, dying or the like, are called diagnoſtic ſigns. Thoſe which foretel the future ſtate thereof, are called prognoſtic ſigns. And that ſign which is peculiar to the diſeaſe, and inſeparable from it, as ariſing from the nature thereof, is called a pathognomonic ſign.

SIGN, in aſtronomy, the twelfth part of the ecliptic, or a portion containing thirty degrees thereof.

The antients divided the ecliptic into twelve ſegments, called ſigns, which they denominated from the conſtellations, which, at the time the names were impoſed, were ſituated near thoſe portions of the ecliptic. But the conſtellations, by the preceſſion of the equinox, have changed their places, the conſtellation Aries being got into the ſign Taurus, and the conſtellation Taurus into the ſign Gemini, &c. The names and order of the twelve ſigns are as follow:

Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius and Piſces, the firſt ſix of which are called northern ſigns, and the latter ſouthern ſigns.

SIGN-MANUEL, in law, is uſed to ſignify any bill, or writing, ſigned by the king's own hand.

SIGNAL, a certain ſign agreed upon for the conveying of intelligence, where the voice cannot reach.

Signals are given for the beginning of a battle, or an attack, uſually with drums and trumpets; at ſea they are given by firing guns, by lights, ſails, flags, &c.

Signals have been in uſe in all ages. The ancients, who had no regular couriers or poſts, made uſe thereof to convey intelligence of what paſſed at a great diſtance. For which purpoſe they placed centinels on the eminences, from ſpace to ſpace; ſome mention whereof we find made by Homer himſelf, Iliad. Θ. v. 553, &c. Odyſſ. Ξ. v. 261. Thoſe people, thus diſpoſed, lighted fires, or flambeaux, in the night-time. In the Agamemnon of Æſchylus, that prince, at his departure for Troy, promiſes Clytemneſtra, that, the very day the city ſhould be taken, he would apprize her of his victory by fires lighted expreſs. He keeps his word, and tidings are brought the princeſs, that Troy is taken, and that Agamemnon's ſignals are ſeen. Frontinus obſerves, they were in uſe among the Arabs; and Bonaventura Vulcanius, in his Scholia on Ariſtotle's book De Mundo, adds, that while the Moors were maſters of the greateſt part of Spain, they built, on the tops of the mountains, an infinity of turrets, or watch-houſes, called, in the Arabic, atalayas, a word the Spaniards ſtill retain; whence, by fires, they could immediately alarm the whole kingdom. Indeed the cuſtom was much more ancient than the Moors in Spain. Q. Curtius obſerves, it was very frequent among the Aſiatics, in the time of Alexander. Livy and Cæſar both mention it as uſed among the Romans. Polydore Virgil ſhews it of great antiquity in England; and Boethius adds, that, in ſeveral places in England, there are the remains of huge poles that have ſerved for this purpoſe.

SIGNALS *at Sea*, are ſigns made by the admiral or commander in chief of a ſquadron of ſhips, either in the day or by night, whether for ſailing, for fighting, or for the better ſecurity of the merchant ſhips under their convoy.

Theſe ſignals are very numerous and important; being all appointed and determined by order of the lord high-admiral, or lords of the admiralty; and communicated in the inſtructions ſent to the commander of every ſhip of the fleet or ſquadron before their putting out to ſea.

SIGNALS *by Day*. When the commander in chief would have them prepare for ſailing, he firſt looſes his fore-top-ſail, and then the whole fleet are to do the ſame. When he would have them unmoor, he looſes his main-top-ſail, and fires a gun, which in the royal navy is to be anſwered by every flag-ſhip. When he would have them weigh, he looſes his fore-top-ſail, and fires a gun, and ſometimes hawls home his ſheets: the gun is to be anſwered by every flag-ſhip, and every ſhip to get to ſail as ſoon as it can. If with the leeward-ſide, the ſternmoſt ſhip is to weigh firſt. When he would have the weather-moſt and head-moſt ſhips to tack firſt, he hoiſts the union-flag at the fore-top-maſt-head, and fires a gun, which each flag-ſhip anſwers; but, if he would have the ſtern-moſt and leeward-moſt ſhips to tack firſt, he hoiſts the union-flag at the mizen top-maſt-head, and fires a gun; and, when he would have all the whole fleet tack, he hoiſts an union, both on the fore and mizen-top-maſt-heads, and fires a gun. When, in bad weather, he would have them wear, and bring to the other tack, he hoiſts a pendant on the enſign-ſtaff, and fires a gun; and then the leeward-moſt and ſternmoſt ſhips are to wear firſt, and bring on the other tack, and lie by, or go on with an eaſy ſail, till he comes a-head: every flag is to anſwer with the ſame ſignal. If they are lying by, or ſailing by a wind, and the admiral would have them bear up and ſail before the wind, he hoiſts his enſign and fires a gun, which the flags are to anſwer: and then the leeward-moſt ſhips are to bear up firſt, and to give room for the weather-moſt to wear, and ſail before the wind with an eaſy ſail, till the admiral comes a-head. But if it ſhould happen, when the admiral hath occaſion to wear and ſail before the wind, that both jack and enſign be abroad, he will haul down the jack, before he fires the gun to wear, and keep it down till the fleet is before the wind. When they are ſailing before the wind, and he would have them bring to, with the ſtar-board tacks aboard, he hoiſts a red flag at the flag-ſtaff, on the mizen-top-maſt-head, and fires a gun. But if they are to bring to with the lar-board tack, he hoiſts a blue flag at the ſame place, and fires a gun, and every ſhip to anſwer the gun. When any ſhip diſcovers land, he is to hoiſt his jack and enſign and keep it abroad, till the admiral or commander in chief anſwers him, by hoiſting his; on ſight of which, he is to hawl down his enſign. If any diſcovers danger, he is to tack and bear up from it, and to hang his jack abroad from the main-top-maſt croſs-trees, and fire two guns: but, if he ſhould ſtrike or ſtick faſt, then, beſides the ſame ſignal with his jack, he is to keep firing, till he ſees all the fleet obſerve him, and endeavour to avoid the danger. When any ſees a ſhip or ſhips more than the fleet, he is to put abroad his enſign, and there keep it, till the admiral's is out, and then to lower it, as often as he ſees ſhips, and ſtand in with them, that ſo the admiral may know which way they are, and how many; but if he be at ſuch a diſtance, that the enſign cannot well be diſcovered, he is then to lay his head towards the ſhip or ſhips ſo deſcried, and to brail up his

low ſails, and continue hoiſting and lowering his top-ſails, and making a waſt with his top-gallant ſails, till he is perceived by the admiral. When the admiral would have the vice-admiral, or he that commands in the ſecond poſt of the fleet, to ſend out ſhips to chace, he hoiſts a flag, ſtriped white and red, on the flag-ſtaff, at the fore-top-maſt head, and fires a gun. But, if he would have the rear-admiral do ſo, he then hoiſts the ſame ſignal on the flag-ſtaff, at the mizen-top-maſt-head, and fires a gun. When the admiral would have any ſhip to chace to windward, he makes a ſignal for ſpeaking with the captain, and he hoiſts a red flag in the mizen-ſhrowds, and fires a gun: but, if to chace to leeward, a blue flag; and the ſame ſignal is made by the flag in whoſe diviſion that ſhip is. When he would have them give over chace, he hoiſts a white flag on his flag-ſtaff at the fore-top-maſt-head, and fires a gun: which ſignal is to be made alſo by that flag-ſhip which is neareſt the ſhip that gives chace, till the chacing ſhip ſees the ſignal. In caſe of ſpringing a leak, or any other diſaſter that diſables their ſhip from keeping company, they are to hawl up their courſes, and fire two guns. When any ſhip would ſpeak with the admiral, he muſt ſpread an Engliſh enſign, from the head of his main, or fore-top-maſt, downwards on the ſhrowds, lowering his main, or fore-top-ſail, and firing guns, till the admiral obſerve him; and if any ſhip perceive this, and judgeth the admiral doth not, that ſhip muſt make the ſame ſignal, and make the beſt of his way to acquaint the admiral therewith, who will anſwer by firing one gun. When the admiral would have the fleet to prepare to anchor, he hoiſts an enſign, ſtriped red, blue, and white, on the enſign-ſtaff, and fires a gun, and every flag-ſhip makes the ſame ſignal. If he would have the fleet moor, he hoiſts his mizen-top-ſail, with the clew-lines hawled up, and fires a gun. If he would have the fleet cut or ſlip, he looſes both his top-ſails, and fires two guns; and then the leeward ſhips are to cut or ſlip firſt, to give room to the weathermoſt to come to ſail. So if he would have any particular ſhip to cut or ſlip, and to chace to windward, he makes the ſignal for ſpeaking with that ſhip, hoiſts a red flag in the mizen ſhrowds, and fires a gun: but, if the ſhip is to chace to leeward, he hoiſts a blue flag as before. If he would have the fleet exerciſe their ſmall arms, he hoiſts a red flag on the enſign-ſtaff, and fires a gun; but, if the great guns, then he puts up a pendant over the red flag.

SIGNALS *by Night*.—To be obſerved at an anchor, weighing anchor, and ſailing, are as follow. When the admiral would have the fleet to unmoor, and ride ſhort, he hangs out three lights, one over another in the main-top-maſt ſhrowds, over the conſtant light in the main-top, and fires two guns, which are to be anſwered by flag-ſhips: and each private ſhip hangs out a light in the mizen ſhrowds. Note, That all guns, fired for ſignals in the night, muſt be fired on the ſame ſide, that they may make no alteration in the ſound. When he would have them weigh, he hangs a light in the main-top-maſt ſhrowds, and fires a gun, which is to be anſwered by all the flags, and every private ſhip muſt hang out a light in his mizen-ſhrowd. When he would have them tack, he hoiſts two flags on the enſign-ſtaff, one over another, above the conſtant light in his poop, and fires a gun, which is to be anſwered by all the flags; and every private ſhip is to hang out a light extraordinary, which is not to be taken in, till the admiral takes in his. After the ſignal is made, the leeward-moſt and ſtern-moſt ſhips muſt tack as faſt as they can, and the ſtern-moſt flag-ſhip, after he is about on the other tack, is to lead the fleet, and him they are to follow, to avoid running foul of one another in the dark. When he is upon a wind, and would have the fleet veer, and bring to on the other tack, he hoiſts up one light at the mizen-peek, and fires three guns, which is to be anſwered by the flag-ſhips, and every private ſhip muſt anſwer, with one light at the mizen-peek. The ſtern-moſt and leeward-moſt ſhips are to bear up as ſoon as the ſignal is made. When he would have them, in blowing weather, to lie a try, ſhort, or a hull, or with the head-ſails braced to the maſt, he will form lights of equal height, and fire five guns, which are to be anſwered by the flag-ſhips; and then every private ſhip muſt ſhew four lights: and after this, if he would have them to make ſail, he then fires ten guns, which are to be anſwered by all the flags, and then the head-moſt and weather-moſt ſhips are to make ſail firſt. When the fleet is ſailing large, or before the wind, and the admiral would have them bring to, and lie by with their ſtar-board tacks aboard, he puts out four lights in the fore-ſhrowds, and fires ſix guns; but if with the larboard tacks aboard, he fires eight guns, which are to be anſwered by the flag-ſhips; and every private ſhip muſt ſhew four lights. The wind-moſt ſhips muſt bring to firſt. Whenever the admiral alters his courſe, he fires one gun, without altering his lights, which is to be anſwered by all the flag-ſhips. If any ſhip hath occaſion to lie ſhort, or by, after the fleet hath made ſail, he is to fire one gun, and ſhew three lights in his mizen-ſhrowds. When any one firſt diſcovers land, or danger, he is to ſhew as many ſigns as he can, to fire one gun, and to tack, or bear away, from it: and if any one happen to ſpring a leak, or any be diſabled from keeping company with the fleet, he hangs out two lights of equal height, and fires guns till he is relieved by ſome ſhip of the fleet. If any one diſcovers a fleet, he is to fire guns, make falſe fires, put one light out on the main-top, three on the poop, to ſteer after them, and to continue firing of guns, unleſs the admiral call him off, by ſteering another courſe, and fire two or three guns; for then he muſt follow the admiral. When the admiral anchors, he fires two guns, a ſmall ſpace of time one from the other, which are to be anſwered by the flag-ſhips; and every private ſhip muſt ſhew two lights. When the admiral would have the fleet to moor, he puts a light on each top-maſt-head, and fires a gun, which is to be anſwered by the flag-ſhips, and every private ſhip is to ſhew one light. If he would have them lower their yards and top-maſts, he hoiſts one light upon his enſign-ſtaff, and fires one gun; which is to be anſwered by the flag-ſhips, and every private ſhip muſt ſhew one light. And when he would have them hoiſt their yards and top-maſts, he puts out two lights, one under the other, in the mizen-top-maſt-ſhrowds, and fires one gun; which is to be anſwered by the flag-ſhips, and each private ſhip muſt ſhew one light in the mizen-ſhrowds. If any ſtrange ſhip be diſcovered coming into the fleet, the next ſhip is to endeavour to ſpeak with her, and bring her to an anchor, and not ſuffer her to paſs through the fleet. And if any one diſcovers a fleet, and it blow ſo hard that he cannot come to give the admiral notice timely, he is to hang out a great number of lights, and to continue firing gun after gun, till the admiral anſwers him with one. When the admiral would have the fleet to cut or ſlip, he hangs out four lights, one at each main-yard-arm, and at each fore-yard-arm, and fires two guns, which are to be anſwered by the flag-ſhips, and every private ſhip is to ſhew one light.

SIGNALS *uſed, when a Fleet ſails in a fog*.—If the admiral would have them weigh, he fires ten guns; which every flag-ſhip is to anſwer. To make them tack, he fires four guns, which are to be anſwered by the flag-ſhips; and then the leeward-moſt and ſtern-moſt ſhips muſt tack firſt, and, after they are about, to go with the ſame ſail they tacked with, and not to lie by, expecting the admiral to come a-head: and this is to avoid the danger of running foul of one another in thick weather.

When the admiral brings to, and lies with his head-ſails to the maſt: if with the ſtar-board tack aboard, he fires ſix guns; but, if with the lar-board tack, he fires eight guns, which the flag-ſhips are to anſwer. And after this, if he makes ſail, he fires ten guns, which the flag-ſhips muſt anſwer, and then the head-moſt and weather-moſt ſhips are to make ſail firſt. If it grow thick and foggy weather, the admiral will continue ſailing, with the ſame ſail ſet that he had before it grew foggy, and will fire a gun every hour, which the flag-ſhips muſt anſwer, and the private ſhips muſt anſwer, by firing of muſkets, beating of drums, and ringing of bells. But if he be forced to make either more or leſs ſail than he had, when the fog began, he will fire a gun

every

every half-hour, that the fleet may diſcern, whether they come up with the admiral, or fall a-ſtern of him; and the flags and private ſhips are to anſwer as before. If any one diſcovers danger, which he can avoid, by tacking and ſtanding from it, he is to make the ſignal for tacking in a fog; but if he ſhould chance to ſtrike and ſtick faſt, he is to fire gun after gun, till he thinks the reſt have avoided the danger. When the admiral would have the fleet to anchor, he fires two guns, which the flags are to anſwer; and after he hath been half an hour at an anchor, he will fire two guns more, to be anſwered by the flags, as before; that all the fleet may know it.

SIGNALS *for calling Officers on board the Admiral.* — When the admiral puts abroad an union-flag in the mizen-ſhrowds, and fires a gun, all the captains are to come aboard him: and if, with the ſame ſignal, there be alſo a waſt made with the enſign, then the lieutenant of each ſhip is to come on board. If an enſign be put abroad in the ſame place, all the maſters of the ſhips of war are to come on board the admiral. If a ſtandard on the flag-ſtaff be hoiſted at the mizen-top-maſt-head, and a gun fired, then all the flag-officers are to come aboard the admiral. If the Engliſh flags only, then a ſtandard in the mizen-ſhrowds, and fire a gun: if the flags and land general officers, then the admiral puts abroad a ſtandard at mizen-top-maſt-head, and a pendant at mizen-peek, and fires a gun. If a red flag be hoiſted in the mizen-ſhrowds, and a gun fired; then the captains of his own ſquadron are to come aboard the admiral; and if, with the ſame ſignal, there be alſo a waſt with the enſign, the lieutenant of each ſhip mnſt come aboard. If he hoiſts a white-flag, as before, then the vice-admiral, or he that commands in the ſecond poſt, and all the captains of his ſquadron, are to go on board the admiral: if a blue flag, &c. then the rear-admiral, and the captains of his ſquadron, muſt come on board; and if a waſt, as before, the lieutenants. When a ſtandard is hoiſted on the enſign-ſtaff, and gun fired, the vice and rear-admirals muſt come on board the admiral's ſhip. When the admiral would ſpeak with the captains of his own diviſion, he will hoiſt a pendant on the mizen-peek, and fire a gun: and if with the lieutenants, a waſt is made with the enſign, and the ſame ſignal: for whenever he would ſpeak with the lieutenants of any particular ſhip, he makes the ſignal for the captain, and a waſt alſo with the enſign. When the admiral would have all the tenders in the fleet come under his ſtern, and ſpeak with him; he hoiſts a flag, yellow and white, at the mizen-peek, and fires a gun. But if he would ſpeak with any particular ſhip's tender, he makes a ſignal for ſpeaking with the captain ſhe tends upon, and a waſt with the jack. If all the pinnaces and barges are to come on board, manned and armed, the ſignal is a pendant on the flag-ſtaff, hoiſted on the fore-top-maſt-head, and a gun fired; and if he would have them chace any ſhip, veſſel, or boat, in view, he hoiſts the pendant, and fires two guns. The ſignal for the long boats to come on board him, manned and armed, is the pendant hoiſted on the flag-ſtaff and the mizen-top-maſt-head, and a gun fired; and if he would have them chace any ſhip, veſſel, or boat, in open view, without coming on board him, he hoiſts the pendant, as aforeſaid, and fires two guns. When the admiral would have all the boats in the fleet come on board him, manned and armed, he hoiſts a pendant on the flag-ſtaff, both on the fore-top-maſt, and mizen-top-maſt-head, and fires one gun: but if he would have them chace he hoiſts his pendants, as before, and fires two guns. When the admiral would ſpeak with the victualler, or his agent, he puts an Engliſh enſign in the mizen-top-maſt-ſhrowds; and when with him that hath the charge of the gunner's ſtores, he will ſpread an enſign at his main-top-ſail-yard-arm.

SIGNALS *for managing a Sea-Fight.* When the admiral would have the fleet form a line of battle, one ſhip a-head of another, he hoiſts an union-flag at the mizen-peek, and fires a gun; and every flag-ſhip does the like. But when they are to form a line of battle, one a-breaſt of another, he hoiſts a pendant with the union-flag, &c. When he would have the admiral of the white, or he that commands in the ſecond poſt, to tack, and endeavour to gain the wind of the enemy, he ſpreads a white flag under the flag at the main-top-maſt-head, and fires a gun; and when he would have the vice admiral of the blue do ſo, he doth the ſame with the blue flag. If he would have the vice-admiral of the red do ſo, he ſpreads a red flag from the cap, on the fore-top-maſt-head, downward on the back-ſtay; if the vice-admiral of the blue, he ſpreads a blue flag, &c. and fires a gun. If he would have the rear-admiral of the red do ſo, he hoiſts a red flag at the flag-ſtaff, at the mizen-top-maſt-head: if the rear-admiral of the white, a white flag; if the rear-admiral of the blue, a blue flag, and under it a pendant of the ſame colour, with a gun. If he be to leeward of the fleet, or any part of it, and he would have them bear down into his wake or track, he hoiſts a blue flag at the mizen-peek, and fires a gun. If he would be to leeward of the enemy and his fleet, or any part of it to be to leeward of him; in order to bring theſe ſhips into the line, he bears down with a blue flag at the mizen-peek, under the union-flag, which is the ſignal for battle, and fires a gun: and then thoſe ſhips, that are to leeward of him, muſt endeavour to get into his wake or track, according to their ſtation in the line of battle. When the fleet is ſailing before the wind, and he would have him, who commands in the ſecond poſt, and the ſhip of the ſtar-board quarter to clap by the wind, and come to the ſtarboard tack, he hoiſts a red flag at the mizen-top-maſt-head; but a blue one, if he would have ſhips of the larboard quarter come to the lar-board tack, with a gun. If the van are to tack firſt, he ſpreads the union-flag at the flag-ſtaff, on the fore-top-maſt-head, and fires a gun, if the red flag be not abroad; but if it be, then he lowers the fore-top-ſails a little; and the union flag is ſpread from the cap of the fore-top-maſt downwards; and every flag-ſhip doth the ſame. If the rear be to tack firſt, he hoiſts the union-flag on the flag-ſtaff, at the mizen-top-maſt-head, and fires a gun; which all the flag-ſhips are to anſwer. If all the flag-ſhips are to come into his wake or track, he hoiſts a red flag at his mizen-peek, and fires a gun; and all the flag-ſhips muſt do the ſame. If he would have him that commands in the ſecond poſt of his ſquadron to make more ſail, though he himſelf ſhorten ſail, he hoiſts a white flag on the enſign-ſtaff. But, if he that commands in the third poſt be to do ſo, he hoiſts a blue flag, and fires a gun, and all the flag-ſhips muſt have the ſame ſignal. Whenever he hoiſts a red flag on the flag-ſtaff at the fore-top-maſt-head, and fires a gun; every ſhip in the fleet muſt uſe their utmoſt endeavour to engage the enemy, in the order preſcribed them. When he hoiſts a white flag at his mizen-peek, and fires a gun; then all the ſmall frigates of his ſquadron, that are not of the line of battle, are to come under the ſtern. If the fleet be ſailing by a wind in the line of battle, and the admiral would have them brace their head ſails to the maſt, he hoiſts up a yellow flag, on the flag-ſtaff, at the mizen-top-maſt-head, and fires a gun; which all the flag-ſhips are to anſwer: and then the ſhips in the rear muſt brace firſt. After this, if he would have them fall their head-ſails, and ſtand on, he hoiſts a yellow flag on the flag-ſtaff of the fore-top-maſt-head, and fires a gun, which the flag-ſhips muſt anſwer, and then the ſhips in the van muſt fall firſt, and ſtand on. If, when this ſignal is made, the red flag at the fore-top maſt-head be abroad, he ſpreads the yellow flag under the red. If the fleets being near one another, the admiral would have all the ſhips to tack together, the ſooner to lie in a poſture to engage the enemy; he hoiſts an union-flag on the flag-ſtaves at the fore and mizen-top-maſt-heads, and fires a gun; and all the flag-ſhips are to do the ſame. The fleet being in a line of battle, if he would have the ſhip that leads the van, hoiſt, lower, ſet, or haul, up any of the ſails, he ſpreads a yellow flag, under that at his main-top-maſt head, and fires a gun, which ſignal the flag-ſhips are to anſwer; and then the admiral will hoiſt, lower, ſet, or hawl up the ſail, which he would have the ſhip that leads the van do; which is to be anſwered by the flag-ſhips of the fleet. When the enemy runs, and he would have the whole fleet follow them, he makes all the ſail he can after them himſelf, takes down the ſignal for the line of battle, and fires two guns out of his forechaſe, which the flag-ſhips anſwer; and then every ſhip is to endeavour to come up with, and board the enemy.

enemy. When he would have the chace given over, he hoiſts a white flag at the fore-top maſt-head, and fires a gun. If he would have the red ſquadron drawn into a line of battle, one a-breaſt of another, he puts abroad a flag, ſtriped red and white, on the flag-ſtaff at the main-top-maſt-head, with a pendant under it, and fires a gun: if the white or ſecond ſquadron is to do ſo, the flag is ſtriped, red, white, and blue: if the blue or third ſquadron is to do ſo, the flag is a Genoeſe enſign and pendant; but if they are to draw into a line of battle, one a-head of another, the ſame ſignals are made without a pendant. If they are to draw into the line of battle one a-ſtern of another, with a large wind, and he would have the leaders go with the ſtar-board tacks aboard by the wind; he hoiſts a red and white flag at the mizen-peek, and fires a gun: but if they ſhould go with the lar-board tacks aboard by the wind, he hoiſts a Genoeſe flag at the ſame place; which ſignals, like others, muſt be anſwered by the flag-ſhips.

SIGNATURE, ſigning, a ſubſcription, or the putting one's name at the bottom of an act or deed, in one's own hand-writing.

SIGNATURE *of the Court of Rome*, is a ſupplication anſwered by the pope, whereby he grants a favour, diſpenſation or collation to a beneſice, by putting the fiat to it with his own hand; or the conſenſum is written in his preſence. This ſignature at the bottom of the ſupplication, gives the name to the whole inſtrument.

SIGNATURE, in printing, is a letter put at the bottom of the firſt page, at leaſt, in each ſheet, as a direction to the binder, in folding, gathering, and collating them. The ſignatures conſiſt of the capital letters of the alphabet, which change in every ſheet: if there be more ſheets than letters in the alphabet, to the capital letter is added a ſmall one of the ſame ſort, as A a B b; which are repeated as often as neceſſary. In large volumes it is uſual to diſtinguiſh the number of alphabets, after the firſt three or four, by placing a figure before the ſignature, as 5B 6B, &c.

SIGNATURE is alſo uſed, by ſome naturaliſts, for the reſemblance a vegetable or mineral bears to a part of the human body; which, by ſome fantaſtical people, is ſuppoſed to indicate its virtues and uſe.

SIGNET, one of the king's ſeals, uſed for ſealing his private letters, and ſigning all grants which paſs his majeſty's hand by bill,

SIGNIFICATION, in general, denotes the meaning or import of a word, phraſe, ſign, device, emblem, or the like.

In law, it is uſed for the notifying an act, &c. to the oppoſite party, by a copy thereof given and atteſted by the proper officer,

SIGNIFICAVIT, in law, a writ which iſſues out of the court of chancery, on a certificate given by the ordinary of a perſon's ſtanding excommunicated forty days, in order to have him impriſoned till he ſubmits to the authority of the church,

SILENI, in antiquity, a ſort of heathen demi-gods, the ſame with ſatyrs, which were called Sileni, when they came to be advanced in age.

SILIQUA, in botany, the ſeed veſſels, huſk, pod, or ſhell of a plant of the leguminous kind.

SILIQUOUS PLANTS, thoſe which produce ſiliquæ, or ſeed pods,

SILK, *Sericum*, a very ſoft, fine, bright, delicate thread, the work of an inſect called bombyx, or the ſilk-worm.

In the year 555, two monks brought from the Eaſt-Indies, to Conſtantinople, great quantities of ſilk-worms, with inſtructions for the hatching their eggs, rearing and feeding the worms, drawing out the ſilk, ſpinning and working it. Immediately manufactures were ſet up at Athens, Thebes, and Corinth. About 1130, Roger, King of Sicily, eſtabliſhed a ſilk manufactory at Palermo, and another at Calabria, managed by workmen whom he brought from Athens, Corinth, &c. which that prince had conquered in his expedition to the Holy Land. By degrees the reſt of Italy and Spain learned from the Sicilians and Calabrians, the management of the ſilk-worms, and the working of ſilk; and at length, a little before the reign of Francis I. began to imitate them.

The great advantage flowing from this new manufacture, made king James I. to be very deſirous of its being introduced into England; accordingly it was recommended ſeveral times from the throne, and in the moſt earneſt terms, to plant mulberry trees, &c. for the propagation of ſilk-worms, but unhappily without effect; though from the various experiments inſerted in the Philoſophical Tranſactions, and other places, it appears, that the ſilk-worm thrives, and works as well, in all reſpects, in England, as in any other part of Europe.

The ſilk-worm is an inſect not more remarkable for the precious matter it furniſhes for divers ſtuffs, than for the many forms it aſſumes, before and after its being inveloped in the rich cod or ball it weaves itſelf. From a ſmall egg about the ſize of a pin's head, which is its firſt ſtate, it becomes a pretty big worm, or maggot, of a whitiſh colour, inclining to yellow. In this ſtate it feeds on mulberry-leaves, till, being come to maturity, it winds itſelf up into a ſilken bag, or caſe, about the ſize and ſhape of a pigeon's egg; and becomes metamorphoſed into an aurelia: in this ſtate it remains without any ſigns of life, or motion; till at length it awakes, to become a butterfly; after making itſelf a paſſage out of its ſilken ſepulchre. And, at laſt, dying indeed, it prepares itſelf, by an egg, or ſeed it caſts, for a new life; which the warmth of the ſummer weather aſſiſts it in reſuming.

As ſoon as the ſilk-worm is arrived at the ſize and ſtrength neceſſary for beginning his cod, he makes his web; for it is thus they call that ſlight tiſſue, which is the beginning and ground of this admirable work. This is his firſt day's employment. On the ſecond, he forms his folliculus or ball, and covers himſelf almoſt over with ſilk. The third day he is quite hid, and the following days employs himſelf in thickening and ſtrengthening his ball, always working from one ſingle end, which he never breaks by his own fault, and which is ſo fine, and ſo long, that thoſe who have examined it attentively, think they ſpeak within compaſs, when they affirm, that each ball contains ſilk enough to reach the length of ſix miles.

In ten days time, the ball is in its perfection, and is now to be taken down from the branches of the mulberry-tree, where the worms have hung it. But this point requires a deal of attention, for there are ſome worms more lazy than others, and it is very dangerous waiting till they make themſelves a paſſage, which uſually happens about the fifteenth day of the month.

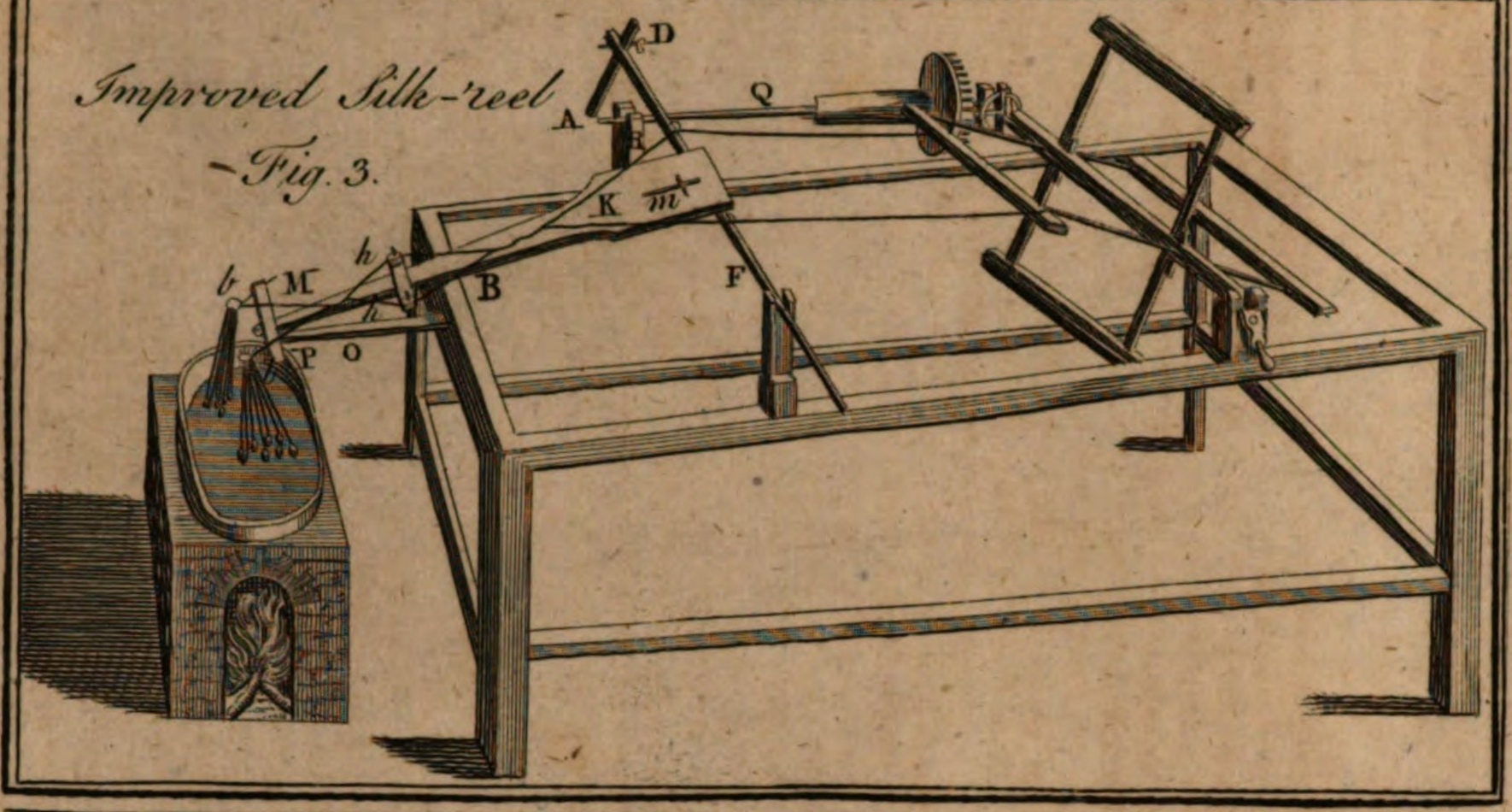
The firſt, fineſt, and ſtrongeſt balls are kept for the grain, the reſt are carefully wound; or if it is deſired to keep them all, or if there be more than can be well wound at once, they lay them for ſome time in an oven moderately hot, or elſe expoſe them, for ſeveral days ſucceſſively, to the greateſt heats of the ſun, in order to kill the inſect, which, without this precaution, would not fail to open itſelf a way to go and uſe thoſe new wings abroad, it has acquired within.

Ordinarily, they only wind the more perfect balls; thoſe that are double, or too weak, or too coarſe, are laid aſide, not as altogether uſeleſs, but that, being improper for winding, they are reſerved to be drawn out into ſkains. The balls are of different colours; the moſt common are yellow, orange-colour, iſabella, and fleſh-colour; there are ſome alſo of a ſea-green, others of a ſulphur-colour, and others white; but there is no neceſſity for ſeparating the colours and ſhades to wind them apart, as all the colours are to be loſt in the future ſcouring and preparing of the ſilk.

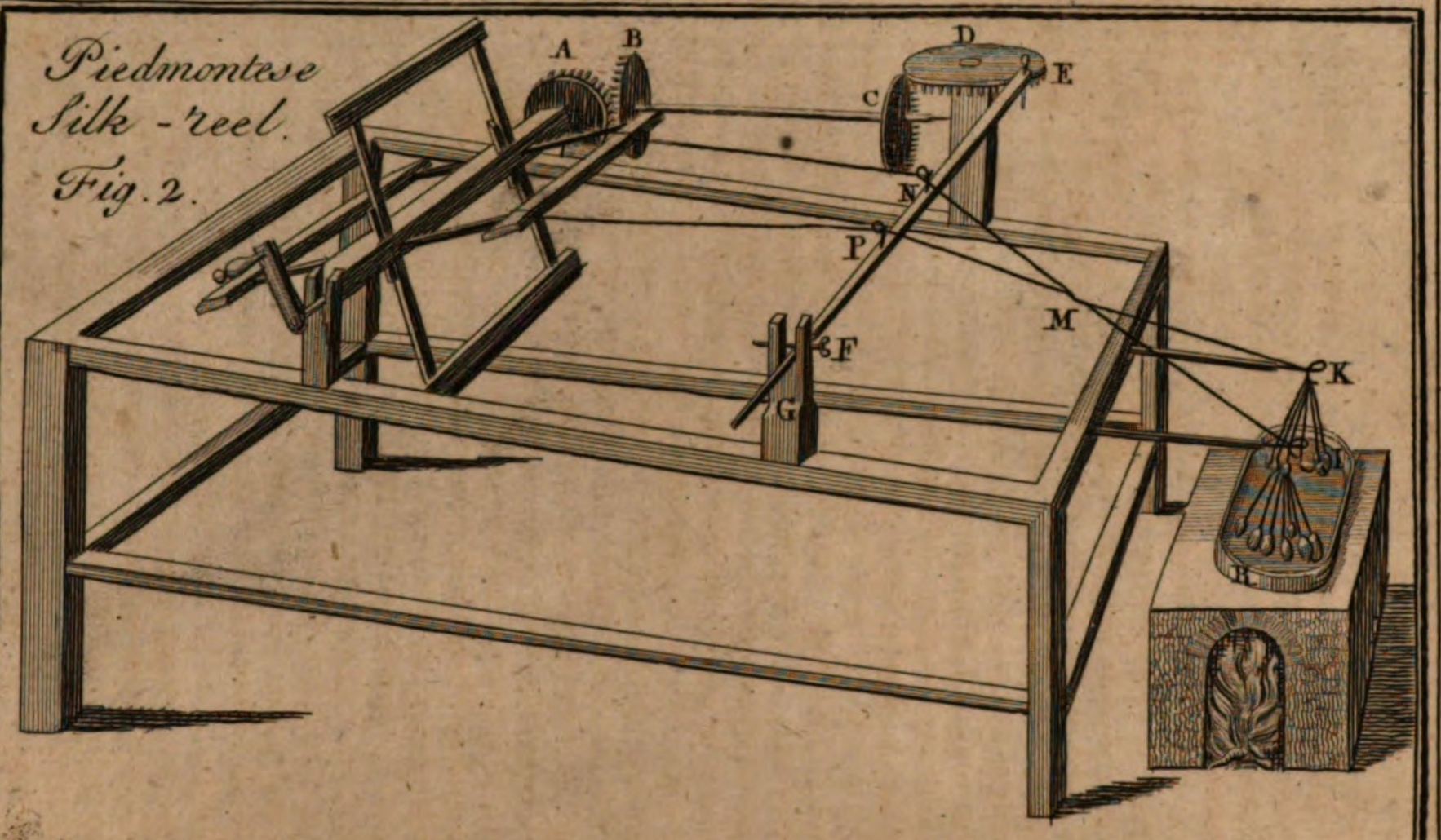
To wind SILK *from off the Balls.* Two machines are neceſſary, the one a furnace, with its copper; the other a reel, or frame, to draw the ſilk. The winder, then, ſeated near the furnace, throws into the copper of water over the furnace, firſt heated and boiled to a certain degree, which cuſtom alone can teach, a handful or two of balls, which have been firſt well purged of all their looſe furry ſubſtance. He then ſtirs the whole very briſkly about with birchen rods, bound and cut like bruſhes; and, when the heat and agitation have detached the ends of the ſilks of the pods, which are apt to catch on the rods, he draws them forth, and joining ten or twelve,

or

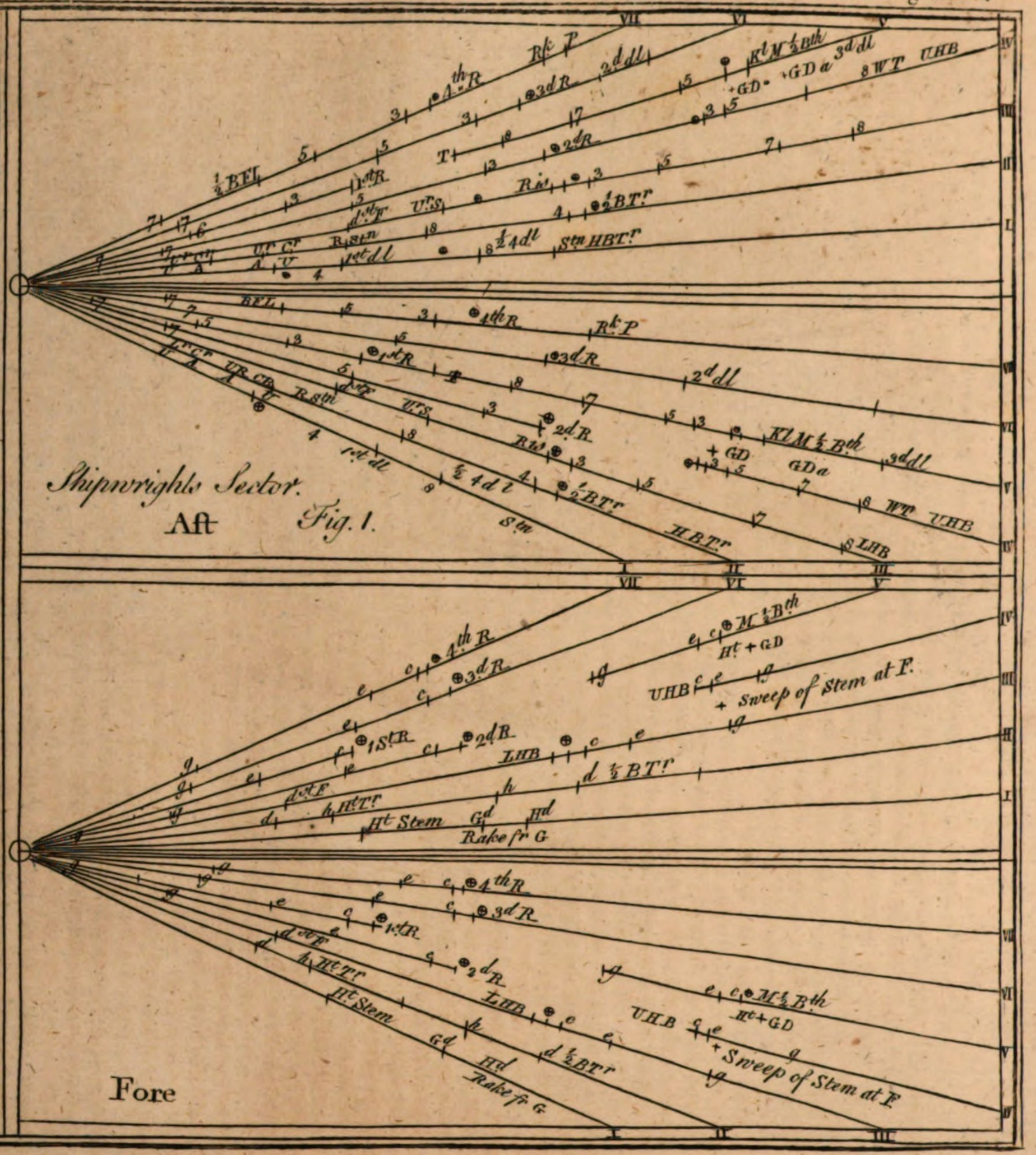
Improved Silk-reel
Fig. 3.



Piedmontese Silk-reel.
Fig. 2.



Shipwrights Sector.
Fig. 1.



er even fourteen of them together, he forms them into threads, according to the bigneſs required to the works they are deſtined for; eight ends ſufficing for ribbands, and velvets, &c. requiring no leſs than fourteen. The ends, thus joined into two or three threads, are firſt paſſed into the holes of three iron rods, in the fore part of the reel, then upon the bobbins, or pullies, and at laſt are drawn out to the reel itſelf, and there faſtened; each to an end of an arm or branch of the reel. Thus diſpoſed, the workman, giving motion to the reel, by turning the handle, guides his threads, ſubſtitutes new ones, when any of them break, or any of the balls are wound out; ſtrengthens them, where neceſſary, by adding others; and takes away the balls wound out, or that, having been pierced, are full of water.

In this manner, two workmen will ſpin and reel three pounds of ſilk in a day; which is done with greater diſpatch than is made by the ſpinning-wheel or diſtaff. Indeed, all ſilks cannot be ſpun and reeled after this manner; either by reaſon the balls have been perforated by the ſilk-worms themſelves, or becauſe they are double, or too weak to bear the water; or becauſe they are coarſe, &c. Of all theſe together, they make a particular kind of ſilk, called floretta, which being carded, or even ſpun on the diſtaff, or the wheel, in the condition it comes from the ball, makes a tolerable ſilk.

As to the balls, after opening them with ſciſſars, and taking out the inſects, which are of ſome uſe for the feeding of poultry, they are ſteeped three or four days in troughs, the water whereof is changed every day to prevent their ſtinking. When they are well ſoftened by this ſcouring, and cleared of that gummy matter the worm had lined the inſide withal, and which renders it impenetrable to the water, and even to air itſelf, they boil them half an hour in a lye of aſhes, very clear and well ſtrained: and after waſhing them out in the river, and drying them in the ſun, they card and ſpin them on the wheel, &c. and thus make another kind of floretta, ſomewhat inferior to the former.

As to the ſpinning and reeling of raw ſilks off the balls, ſuch as they are brought from Italy and the Levant, the firſt is chiefly performed on the ſpinning wheel; and the latter, either on hand-reels, or on reels mounted on machines, which ſerve to reel ſeveral ſkains at the ſame time.

As to the milling, they uſe a mill compoſed of ſeveral pieces, which may mill two or three hundred bobbins at once, and make them into as many ſkains.

The following is an account of a new improved SILK *Reel*, by the reverend Samuel Pullein, and it is hoped, will help to promote the culture of ſilk in our American colonies, and to bring it to that perfection which at preſent is ſcarce found in any country but Piedmont.

"When ſilk is reeled from the cocoons, the thread is ſmeared with the natural gum of the ſilk ſoftened by the heat of the water out of which it is reeled. If the ſeveral rounds of this thread, as it falls on the reel, touch one another in their whole extent, it is then ſo glued together, as to be entirely uſeleſs for any perfection of manufacture, it being impoſſible to wind it off without tearing and breaking. This fault in the ſilk countries goes under the technical name of the vitrage; and there are many degrees of it, according to the cauſe by which it is produced.

"From the introduction of ſilk into Europe to this day, the preventing of the vitrage has employed ſome of the moſt knowing men in the countries where ſilk is produced.

"To change the poſition of the ſilk thread, that it might not always fall on the ſame part of the reel, the guide-ſtick was introduced. This received a progreſſive and regreſſive motion, by means of two wheels, the one fixed to the axle of the reel, and communicating its motion to the other by means of a band.

"To make theſe wheels perfect, certain determined and preciſe proportions are to be obſerved in the diameters of their grooves, otherwiſe, notwithſtanding the motion of the guide-ſtick, there may be a total vitrage of the whole hank of ſilk; and, even when the proportion of the wheels is perfect, there may be reckoned up thirteen or fourteen accidents, any of which happening will cauſe a vitrage: but though theſe inconveniencies attend all thoſe reels which uſe a band, yet, becauſe the ordinary ſort of them are eaſily made, they are ſtill uſed by the common people in moſt ſilk countries.

"No nation has brought its ſilk to a greater perfection than the Piedmonteſe: but it was only by ſlow degrees, and in a long tract of time, that they arrived at this. They firſt ſuppreſſed the old method of reeling the ſilk over a bobbin, which was found to give it a flat form; and they ſubſtituted in its ſtead that excellent method of the croiſſure, which renders it round and compact. They then applied themſelves to correct the imperfections of the guide-ſtick, and to eſtabliſh proper proportions between the wheels which gave it motion: but, notwithſtanding theſe and other improvements, they ſtill found, that, ſo long as theſe wheels were turned by means of a band, they could not arrive at the perfection neceſſary to make ſilk fit for organcine or warp, becauſe the inaccurate motion of the band made the moſt juſt proportion which they could eſtabliſh between the wheels quite ineffectual, and conſtantly produced a vitrage.

"It was on this account that they totally ſuppreſſed the uſage of the band, and ſubſtituted in its place four wheels, with a determined number of teeth, whoſe revolutions, being uniform, gave the guide-ſtick a proper motion for preventing the vitrage. This, and ſome other regulations are eſtabliſhed by laws, which are rigorouſly put in execution, leſt the common people ſhould, through indolence, relapſe into their old cuſtoms. By adhering to this reel, the Piedmonteſe are able to give that perfection to their raw ſilk, which fits it to be thrown into organcine or warp; and to raiſe the value of each pound of ſilk reeled in this manner to one third more than it would have, if reeled otherwiſe.

"The French were deſirous of making raw ſilk fit for organcine or warp among themſelves, which hitherto they have had from Piedmont. Whether they thought the Piedmonteſe reel could not eaſily be brought into common uſe, or whether a little vanity hindered them from copying or improving the inventions of other nations, I will not determine. However that be, they applied themſelves wholly to the improvement of the band-reel.

"Two perſons, viz. M. St. Prieſt of Languedoc, and M. Vaucançon of the Academy of Sciences at Paris, have, within theſe nine or ten laſt years, brought the band-reel to the greateſt perfection of which it is capable. Either of their reels will make raw ſilk fit for organcine or warp, provided they are accurately made; but a ſmall error in their conſtruction deſtroys their perfection. I have now in my poſſeſſion a reel made according to M. Vaucançon's method; where I can ſhew, that in two wheels, whoſe diameters differ but very inconſiderably, one ſhall reel the ſilk properly, and the other throw it into a total vitrage. I have, however, given a deſcription and plate of this reel, in a treatiſe on the culture of ſilk, which I publiſhed ſome time ago, becauſe its contrivance is more ſimple than that of M. St. Prieſt, and performs as well.

"The Piedmonteſe reel is free from the inconveniencies of all thoſe reels which uſe a band; the maker cannot eaſily err in the conſtruction; the weather cannot affect its operation; nor is it ſubject, during its work, to the many irregularities of the band-reel. The chief objections which have hindered its being commonly uſed are, that four toothed wheels are more difficult to be made than two plain grooved ones; and that being made only of wood they are eaſily broken. So that it is neceſſary to have a double ſet of them, in order to prevent thoſe delays which might happen by their breaking; becauſe any delay in the reeling of ſilk occaſions a conſiderable detriment.

"Our happier conſtitution doth not admit ſuch rigorous laws as that of Piedmont. To make the common people adopt any new contrivance, they muſt not only know that it is the beſt, but they muſt alſo feel that it can be eaſily practiſed. Thoſe who ſuperintend public filatures in our colonies may indeed, for the preſent, keep their workmen to the Piedmonteſe reel; but public filatures can no more produce large quantities of ſilk than public ſpinning houſes could produce the vaſt quantities of linen-yarn which are now raiſed from private family-wheels:

and when the management of ſilk-worms becomes more common in our colonies, and people find that, by reeling their own cocoons, their profit will be nearly doubled, and this with much leſs labour than was uſed in rearing the worms; when this I ſay, ſhall happen, and it is to be hoped it ſoon will, then the making of the Piedmonteſe reel more ſimple, and more familiar to the common people, will I believe appear a thing of conſiderable importance to our ſilk manufactures.

"I ſometime ago turned my thoughts to the effecting of this; and ſhould before now have put them in execution, had I not diſtruſted my own abilities to perform a thing, which the Piedmonteſe themſelves had not attempted. I have now conſtructed a reel, which, without any additional mechaniſm, performs the work of the Piedmonteſe reel, and uſes but two wheels with teeth inſtead of four wheels. It has been examined by ſome gentlemen in the ſilk-trade, who are well acquainted with the reels of that country, and allowed to work with much more ſimplicity, and greater perfection. Nor can I account why this improvement was not before attempted, but from the ſtrong biaſs of habit confining the powers of invention.

"Some advantages, which this reel ſeems to have above the preſent Piedmonteſe reel, are, 1. that by a new proportion ſtruck between the wheels, the ſilk thread will not be laid in the ſame place on the reel till after the winding of near ſix hundred yards: by which means, the thread having time to dry, all vitrage is avoided; whereas thoſe now uſed do not reel above an hundred and fifty yards till the thread is laid in the ſame place.

"Secondly, I have added to this reel an improved method of making the double croiſſure in as eaſy a manner as the Piedmonteſe now make the ſingle one; the double croiſſure giving a conſiderable perfection to the ſilk above what it obtains from the ſingle one.

"As the limits to which I purpoſe confining this account will not allow of a more extended deſcription, which, to gentlemen not verſed in theſe matters, may already be thought too long, I ſhall avoid a greater treſpaſs on your attention, by a brief reference to the annexed figure. (See plate CXVIII. *fig.* 2.)

"*Fig.* 1. repreſents the preſent Piedmonteſe reel. The poſition of the four wheels is ſhewn at A, B, C, and D: the toothed wheel A is fixed upon the axle of the reel; and, as the reel turns, it gives motion to the two wheels B and C, which are fixed upon one common arbre. The wheel C moves the wheel D, which is placed horizontal; and this, as it revolves, makes the guide-ſtick E F play forward and backward in a groove made in the upright G, the guide-ſtick playing freely on a pin E fixed in this wheel. Two threads of ſilk, drawn from two parcels of cocoons, which lie in the copper of hot water R, are paſſed through the two loops of the ſtop-wires K and L: they then are twiſted round each other at M, which is the ſingle croiſſure of the Piedmonteſe. At M they are again ſeparated, and paſs each through its own guide wire at N and P; and from theſe they go to the reel, where, as the reel turns, the motion of the guide-ſtick continually varies their poſition, and hinders them to be laid on the ſame place.

"*Fig.* 3. exhibits the new conſtruction which I have given to this reel. The two wheels C and D of *fig.* 2. are laid aſide as ſuperfluous: the arbre Q paſſes through a nich in an upright ſupporter R, and, by a winch at its end A, gives motion to the guide-ſtick. The plane of its motion in the Piedmonteſe reel is horizontal, but here it is perpendicular. This perhaps made them think that the effect would not be the ſame; but it doth not cauſe any eſſential difference; and if it had, there was a moſt eaſy remedy for it.

"Here therefore the expence and trouble of making and adjuſting two wheels and two ſets of teeth are ſaved, the hazard of breaking and going out of order leſſened, and the machine made more ſimple, and more familiar to the underſtanding.

"A ſhews the manner in which I have made a winch D, fixed in the arbre Q A, and anſwers the ſame purpoſe as the two wheels with teeth, which are uſed in the Piedmonteſe reel; by which the mechaniſm is rendered more ſimple, and the guide-ſtick F moved to the ſame advantage as with the wheels. At *b b* are fixed two little ivory or braſs wheels with ſmooth acute angled grooves in them to receive the threads which come from the two ſtop-wires *b b*. One end of the ſwivel croſs K is ſomewhat broad, and reſts upon the guide-ſtick F, directly in the middle between the two guide-wires *c c*. Here it moves and plays freely on a pin fixed in the guide-ſtick, the pin paſſing through the nich *m*. The other end of the ſwivel M contains the ſtop-wires *b b*, and is attached to the end of the rod O, which projects from the front bench of the reel. This attachment is made by means of a piece of packthread, with a knot on its end; which packthread paſſes through a hole in the ſwivel and in the piece O, and being fixed to a peg P, which turns in the under part of the piece O, is drawn to a proper degree of tenſion to allow, the ſwivel to obey all the motions of the guide-ſtick.

"The manner of making the double croiſſure is thus: the two ſilk threads are paſſed through the two ſtop-wires *b b*, and through the two guide-wires *c c*, and ſo are faſtened to the reel. Then either of the two threads is taken in that part of it which lies between the ſtop-wire and guide-wire, and turned two or three times round the other thread; and then each thread is placed in the groove of the pully at *b b*, taking care to place each in the groove of that pulley which lies on the ſide of its own ſtop-wire. The threads will then appear in the ſituation repreſented in the figure, twiſted round one another in the two points *o* and *p*.

"The great advantage of this method is the taking off the preſſure of the threads, by making them paſs over two pullies inſtead of two hooks; and by the ſwivel complying with all the motions of the guide-ſtick, which keeps the angles of the croiſſure conſtantly the ſame: without this, the bearing of the threads and the variation of the angles will make them ſo liable to break, that, from many experiments which I have made, I might venture to ſay, that though the double croiſſure has many advantages in compacting the ſilk thread, and ſhaking off its moiſture, yet without ſuch contrivance it will ſcarce ever be put in practice. I muſt alſo take notice, that this contrivance is vaſtly more ſimple than that which M. Vaucançon uſes, though his has no one of theſe advantages." See the *Phil. Tranſ. for* 1759. *page* 21.

Raw SILK, that taken from the ball without fire, and wound without any coction; ſuch is moſt, if not all, that is brought into England from the Levant.

Boiled SILK, that which has been boiled in water, to facilitate the ſpinning and winding.

Spider SILK.—In the year 1710, Mr. Bonn diſcovered a method of procuring and preparing ſilk of the webs of ſpiders, and uſing it in ſeveral manufactures.

After the death of Mr. Bonn, the French academy appointed the celebrated Reaumur to make a farther enquiry into this new ſilk work, who has raiſed ſeveral objections and difficulties againſt it, which are inſerted in the Memoirs of the Academy for the year 1710. The ſum of what he has urged amounts to this: the natural fierceneſs of the ſpiders, renders them unfit to be bred and kept together: four or five thouſand being diſtributed into cells, 50 in ſome, 100, or 200 in others; the big ones kill and eat the leſs, ſo that in a ſhort time there were left only one or two in each cell: and to this inclination of mutually eating one another Mr. Reaumur aſcribes the ſcarcity of ſpiders, conſidering the vaſt number of eggs they lay.

But this is not all: he even affirms, that the ſpider's bag is inferior to that of the ſilk-worm, both in luſtre and ſtrength; and that it produces leſs matter to be manufactured. The thread of the ſpider's web only bears a weight of two grains without breaking; that of the bag bears 36. The latter, therefore, in all probability, is eighteen times thicker than the former; yet is it weaker than that of the ſilk-worm, which bears a weight of two drams and a half. So that five threads of the ſpider's bag muſt be put together to equal one thread of the ſilk-worm's bag.

Now, it is impoſſible theſe ſhould be applied ſo juſtly over one another, as not to leave little vacant ſpaces between them, whence the light will not be reflected;

and,

and, of conſequence, a thread, thus compounded, muſt fall ſhort of the luſtre of a ſolid thread. Add to this, that the ſpider's thread cannot be wound off, as that of the ſilk-worm may; but muſt, of neceſſity, be carded; by which means being torn in pieces, its evenneſs, which contributes much to its luſtre, is deſtroyed. In effect, this want of luſtre was taken notice of by M. de la Hire, when Mr. Bonn preſented a pair of ſtrockings to the academy.

Again, ſpiders furniſh much leſs ſilk than the worms: the largeſt bags of theſe latter weigh four grains; the ſmaller three grains; ſo that 2304 worms produce a pound of ſilk. The ſpiders bags do not weigh above one grain; yet, when cleared of their duſt and filth, loſe two thirds of their weight. The work of twelve ſpiders, therefore, only equals that of one ſilk-worm; and a pound of ſilk will require at leaſt 27648 ſpiders. But as the bags are wholly the work of the females, who ſpin them to depoſit their eggs in; there muſt be kept 52296 ſpiders, to yield a pound of ſilk. Yet will this only hold of the beſt ſpiders, thoſe large ones ordinarily ſeen in gardens, &c. ſcarce yielding a twelfth part of the ſilk of the others. 280 of theſe, he ſhews would not do more than one ſilk-worm; and 663552 of them would ſcarce yield a pound.

SILK, in medicine, is very little uſed for medicinal purpoſes, though if the bags were burnt in a cloſe veſſel, they would undoubtedly prove a medicine of ſimilar, and probably of ſuperior virtue. They yield a larger quantity of volatile ſalt, than any other animal ſubſtance we know of; and the ſpirit of raw ſilk, rectified with ſome eſſential oil, makes the medicine known by the name of Engliſh drops.

SILLON, in fortification, an elevation of earth made in the middle of the moat, to fortify it, when too broad. It is generally called envelope.

SILVER, *Argentum*, in natural hiſtory, the fineſt and moſt fixed of all metals, except gold.

Silver is a ſoft, flexible metal, of little or no elaſticity: by hammering it becomes moderately hard, elaſtic, and ſonorous; more ſo than gold, leſs than copper or iron. Its ſpecific gravity is to that of water nearly as 10 $\frac{3}{4}$ to 1. It melts in a bright red heat, a little ſooner than gold; and when in fuſion, appears a perfect ſpeculum. Like gold, it continues ductile when heated as well as when cold; loſes a little of its ductility by ſudden cooling; proves brittle when heated by hammering; and regains its priſtine malleability on being nealed, that is, ſlightly ignited and ſuffered to cool very leiſurely. It ſeems to be perfectly fixed in the greateſt degree of culinary fire; the ſmall diminution, which in ſome experiments of this kind has happened at firſt, being apparently not of the ſilver itſelf, but of ſome other metal with which it had been debaſed.

Silver is the moſt perfect, ductile, and fixed in the fire, of all metals after gold. A ſingle grain has been drawn into a wire three yards in length; and the wire flatted into a plate an inch broad. In common fires, it ſuffers no diminution of its weight; and kept in the vehement heat of a glaſs-houſe furnace for a month, it loſes no more than one ſixty-fourth. In the focus of Tſchirnhaus's large burning-glaſs, it ſmokes for a long while, then contracts a greyiſh aſh on the ſurface, and at length is totally diſſipated. The proper menſtruum of ſilver is the nitrous acid; which if well dephlegmated, will diſſolve equal its own weight: the ſolution ſtains the ſkin black. It likewiſe ſtains hair, bones, and other ſolid parts of animals, and different kinds of wood, of all the intermediate ſhades, from a light brown to a deep and laſting black. The liquors commonly ſold for ſtaining hair brown or black, are no other than ſolutions of ſilver in aqua fortis, ſo far diluted with water as not ſenſibly to corrode the hair.

It gives a permanent ſtain likewiſe to ſundry ſtones; not only to thoſe of the ſofter kind, as marble; but to ſome of conſiderable hardneſs, as agates and jaſpers. The ſolution, for this purpoſe, ſhould be fully ſaturated with the metal; and the ſtone, after the liquor has been applied, expoſed for ſome time to the ſun. M. du Fay obſerves, in a paper upon this ſubject in the French Memoirs for the year 1728, that if the ſolution be repeatedly applied, it will penetrate, in the whitiſh agate or chalcedony, about one twelfth of an inch: that the tincture does not prove uniform, on account of veins in the ſtone: that the colours thus communicated by art are readily diſtinguiſhable from the natural, by their diſappearing upon laying the ſtone for a night in aqua fortis; that on expoſing it afterwards to the ſun for ſome days, the colour returns: that the ſolution gave ſomewhat different tinctures to different ſtones; to the oriental agate a deeper black than to the common chalcedony; to an agate ſpotted yellow, a purple; to the jade-ſtone, a pale browniſh; to the common emerald, an opaque black; to common granate, a violet unequally deep; to ſerpentine-ſtone, an olive; to marble, a reddiſh, which changed to a purple, and fixed in a brown: that on ſlates, talcs, and amianthus, it had no effect. Some have thought to increaſe the ſtrength of the acid, by drawing it over from a quantity of freſh nitre; and been ſurpriſed to find, that inſtead of acting more powerfully upon ſilver, it would not now diſſolve that metal at all, only corroding it into a white powder; and that on the other hand, it now proved a menſtruum for gold, which before it had no effect upon. Theſe alterations depend wholly upon the nitre containing ſea ſalt; whoſe acid is expelled in the diſtillation by a part of the nitrous, and forced over along with the reſt: pure ſpirit of nitre, drawn over from pure freſh nitre, diſſolves ſilver, and leaves gold untouched, at firſt.

Solution of ſilver, evaporated a little, ſhoots in the cold into cryſtals, intenſely bitter and corroſive, and hence called by ſome *ſel metallorum*, the gall of metals: the cryſtallization is promoted by dropping in a little ſpirit of wine before the liquor is ſet to ſhoot. The cryſtals, or the ſolution inſpiſſated to dryneſs, melt in a ſmall heat, and form on cooling a dark-coloured maſs ſtill more corroſive, their phlegm having been diſſipated in the fire. This maſs is the lunar cauſtic or infernal ſtone of the ſhops: for the greater conveniency of uſing it as a cauſtic, it is commonly caſt, in proper moulds, into ſlender cylindrical pieces. The cryſtals have been given internally, as purgatives and diuretics, and hence named catharticum lunare, and hydragogum angeli ſalæ: they are a medicine of great activity, too great to be taken with ſafety.

If ſolution of ſilver be diluted with pure water, a conſiderable quantity of pure mercury added, and the whole ſet by in a cold place; there will form by degrees a precipitation and cryſtallization reſembling a little tree, with its root, trunk, and branches, called arbor Dianæ, or the philoſophic ſilver-tree. Lemery gives another method of making an arbor Dianæ, by adding to ſolution of ſilver ſome warm diſtilled vinegar.

Cryſtals of ſilver readily diſſolve in water; and by the aſſiſtance of warmths, in ſpirit of wine. Expoſed for ſome time to a moderately ſtrong fire, they part by degrees with all the acid, and return into ſilver again; though ſcarcely without ſome little loſs, unleſs borax or alcaline fluxes are added, to collect or reunite the particles of the metal. If laid on a burning coal, the nitrous acid, deflagrating with the inflammable matter, as this acid in all its combinations does, is quickly conſumed, and the ſilver revived. I have not, ſays Mr. Lewis, obſerved in this experiment any conſiderable volatilization of the ſilver; though in the *Acta Naturæ Curioſorum*, tom. VI. there is a remarkable hiſtory of ſilver diſſolved in the nitrous acid being volatilized in cloſe veſſels by means of charcoal. Four ounces of pure ſilver being diſſolved in aqua fortis, and the ſolution ſet, to diſtil in an earthen retort; a white tranſparent butter aroſe into the neck, and nothing remained behind: by degrees the butter liquefied, and paſſed down into the phlegm in the receiver: the whole being now poured back into the retort, the ſilver aroſe again along with the acid: on adding ſea ſalt to this volatilized ſolution, the ſilver was precipitated into a luna cornea. The volatilization being attributed to the liquor having ſtood in an elaboratory where charcoal was bringing in, the experiment was repeated with a freſh ſolution of ſilver mixed with a little powdered charcoal, with the ſame event.

Another kind of artificial vegetation, as it is called, may be produced, by ſpreading a few drops of ſolution

of ſilver upon a glaſs-plate; and placing in the middle a ſmall bit of any of the metals that precipitate ſilver, as particularly of iron. The ſilver quickly concretes into curious ramifications all over the ſurface of the plate. Other metallic ſolutions afford alſo vegetations on the ſame treatment; but none ſo elegant ones as that of ſilver.

Silver is precipitated from aqua fortis by all the metals which diſſolve in that acid, readily and copiouſly at firſt, but ſlowly and difficultly towards the end. The menſtruum generally retains ſome portion of the ſilver, as the ſilver almoſt always does of the metal which precipitated it. The refiners, for recovering the ſilver from aqua fortis after parting, employ copper. The ſolution, diluted with water, is put into a copper veſſel, or into a glaſs one with thin plates of copper, and ſet in a gentle warmth; the ſilver begins immediately to ſeparate from the liquor in form of fine grey ſcales or powder; a part of the copper being diſſolved in its place, ſo as to tinge the fluid more and more of a bluiſh green colour: the plates are now and then ſhaken, that ſuch part of the ſilver, as is depoſited upon them, may fall off and ſettle to the bottom. The digeſtion is continued, till a freſh bright plate kept for ſome time in the warm liquor, is no longer obſerved to contract any powdery matter on the ſurface; when the liquor is poured off, and the precipitate waſhed with freſh parcels of boiling water. The ſmall portion of ſilver, which the acid commonly ſtill retains, may be precipitated by common ſalt: the copper which the ſilver retains may be in part ſcorified and ſeparated by fuſion with nitre. It is obſervable, that though the acid, in this proceſs, ſaturates itſelf with the copper in proportion as it lets go the ſilver; yet the quantity of copper which it takes up, is not near ſo great as that of the ſilver which it depoſits. One dram of copper will precipitate three of ſilver, and ſaturate all the acid that held the three drams diſſolved.

Abſorbent earths, as chalk, or quick-lime, throw down a part of the ſilver, but leave a very conſiderable part ſuſpended in the liquor. If the earth be moiſtened with the ſolution into the conſiſtence of a paſte, and expoſed to the ſun, it changes its white colour to a dark purpliſh black: diſtinct characters may be exhibited on the matter, by intercepting a part of the ſun's light by threads, ſlit paper, &c. placed on the outſide of the glaſs. Culinary fire does not affect its colour: after the maſs has been exſiccated by this, it changes as before upon being expoſed to the ſun.

Volatile alkaline ſpirits, added to a ſolution of ſilver, precipitate little. Pure fixed alkalies, and alkalies rendered cauſtic by quick-lime, throw down the whole. Fixed alkalies impregnated with inflammable matter, by calcination with animal coals, occaſion at firſt a conſiderable precipitation, but if added in larger quantity, take up great part of the metal again. Mr. Marggraf relates, that adulterated calces of ſilver totally diſſolve both in a lixivium of theſe alkalies, and in volatile ſpirits; and that the marine acid precipitates the ſilver from the volatile, but not from the fixed alkaline ſolution. Kunckel reports, that the calx precipitated by volatile ſpirits made with quick-lime, fulminates or explodes in the fire: and that by inſpiſſating a ſolution of pure ſilver, melting the dry reſiduum, pouring on it ſpirit of urine, ſuperſaturated with ſalt, and ſetting the mixture in a gentle warmth, a blood-red maſs is produced, ſo tough as to be wound about the fingers.

The marine acid does not diſſolve ſilver, but precipitates it from the nitrous. Upon adding to a ſolution of the metal made in aqua fortis, either the pure acid of ſea ſalt, or the ſalt in ſubſtance, or ſal ammoniac, the liquor inſtantly becomes milky, and, on ſtanding, depoſits the ſilver now combined with the marine acid into a white powder. This, when ſufficiently waſhed with water, proves inſipid, though containing ſo much acid as to weigh one fourth more than the ſilver employed. It does not diſſolve in water, ſpirit of wine, aqua fortis or aqua regis; but is in ſome ſmall degree red hot, and on cooling forms a ponderous browniſh maſs, which if caſt into thin plates proves ſemi-tranſparent, and ſomewhat flexible, like horn: whence its name *luna cornea*. A ſtronger fire does not expel the acid from the ſilver; the whole concrete either ariſing in fumes, or ſinking through the veſſel without any ſeparation of its parts: it may be ſublimed like arſenic, with which it has, in many reſpects, a great analogy. If mixed with fixed alkaline ſalts, or inflammable ſubſtances, as oil or tallow, and melted in a crucible, the acid is abſorbed or expelled, and the ſilver recovered pure.

The vitriolic acid alſo precipitates ſilver from the nitrous; but does not act upon ſilver in its metallic ſtate, unleſs highly concreted and aſſiſted by a boiling heat. The marine acid precipitates ſilver from the vitriolic, in the ſame manner as from the nitrous.

Luna cornea is moſt commodiouſly prepared, by diluting a ſolution of ſilver with ten or twelve times its quantity of water, and adding, by degrees, a ſolution of ſea ſalt, ſo long as it occaſions any turbidneſs or milky hue. The whole is then to be ſet by till the white powder has ſettled; when the clear liquor is to be poured off, and the precipitate waſhed with freſh parcels of boiling water. If the ſilver contained any portion of copper, which it always does after the common methods of purification, that metal will here be ſeparated, and left diſſolved in the liquor; pure ſea ſalt precipitating no metallic body but ſilver, lead, and mercury. Hence ſilver is brought, by this proceſs, to a degree of purity ſcarce procurable by any other known means.

The ſilver may be recovered from the luna cornea, by fuſion with alkaline and inflammable fluxes, or with certain metallic bodies; but in theſe operations, there happens always a conſiderable loſs of the ſilver; a part of the volatile calx being diſſipated by the fire, before the alkali or metal can abſorb its acid. Mr. Marggraf has diſcovered a method of reviving the ſilver with little or no loſs; mercury, aſſiſted by volatile ſalts, imbibing it by trituration without heat. One part of luna cornea and two of volatile ſalt are to be ground together in a glaſs mortar, with ſo much water as will reduce them to the conſiſtence of a thin paſte, for a quarter of an hour or more: five parts of pure quickſilver are then to be added, with a little more water, and the triture continued for ſome hours. A fine amalgam will thus be obtained; which is to be waſhed with freſh parcels of water, ſo long as any white powder ſeparates. Nearly the whole of the ſilver is contained in the amalgam, and may be recovered perfectly pure by diſtilling off the mercury: the white powder holds alſo a ſmall proportion, ſeparable by gentle ſublimation; the matter which ſublimes is nearly ſimilar to mercurius dulcis.

Luna cornea totally diſſolves in volatile alkaline ſpirits, without any ſeparation of the metal. Expoſed to the fire in a cloſe copper veſſel, it penetrates the copper, and tinges it throughout of a ſilver colour. Kunckel obſerves, that when carefully prepared, melted in a glaſs veſſel, and ſuffered to cool ſlowly, to prevent its cracking, it proves clear and tranſparent, may be turned in a lathe, and formed into elegant figures. He ſuppoſes this to be the preparation which gave riſe to the notion of malleable glaſs.

Mercury very readily amalgamates with ſilver leaf. It eaſily unites likewiſe with the calx of ſilver, precipitated by copper: but does not touch the calces precipitated by ſalts.

The vapours of ſulphureous ſolutions ſtain ſilver yellow or black. Sulphur melted with ſilver debaſes its colour to a leaden hue, renders it more eaſily fuſible than alone, and makes it flow ſo thin, as to be apt, in a little time, to penetrate the crucible: in a heat juſt below fuſion, a part of the ſilver ſhoots up, all over the ſurface, into capillary efflorescences. Aqua fortis, the ſolvent of pure ſilver, does not act upon the ſilver in this compound; but fixed alcaline ſalts, the menſtruum of ſulphur, may be made to abſorb that ingredient; the alkali, however, when combined with the ſulphur, will take up the ſilver again. If the ſulphurated ſilver be mixed with mercury ſublimate, and expoſed to the fire, the mercury of the ſublimate will unite with the ſulphur, and carry it up in the form of cinnabar, whilſt the marine acid of the ſublimate unites with the ſilver into a luna cornea, which remains at the bottom of the glaſs: fire alone, continued for ſome time, is ſufficient to expel the ſulphur from ſilver.

Silver is purified from the baſer metals by cupellation with lead. It always retains, however, after that operation, ſome ſmall portion of copper, ſufficient to impregnate volatile ſpirits with a blue tincture, which ſome have erroneouſly ſuppoſed to proceed from the ſilver itſelf. It is purified from this admixture by melting it twice or thrice with nitre and borax: the ſcoriæ, on the firſt fuſion, are commonly blue; on the ſecond, green; and on the third, white, a mark of the purification being completed. But the moſt effectual purification is the revival of ſilver from luna cornea.

Silver is purified and whitened extremely by boiling in a ſolution of tartar and common ſalt. This is no other than an extraction of the cupreous particles from the ſurface of the ſilver, by the acid of the tartar acuated with the common ſalt.

The ſilver employed for coins and utenſils have always an admixture of copper, which improves its hardneſs and ſonorouſneſs. Its degree of fineneſs is expreſſed among us by loths or half ounces: a marck contains ſixteen half ounces; the ſilver is ſaid to be of ſixteen loths, when all the ſixteen half ounces are pure ſilver; of fifteen, when only fifteen half ounces are pure ſilver, and the other copper, &c. — Moſt of the other metallic bodies render it brittle; one part of tin deſtroys the malleability of above an hundred parts of ſilver; and regulus of antimony has this effect in a ſtill greater degree. Both regulus of antimony and arſenic render a part of the ſilver volatile in the fire.

Silver diſcovers, in ſome circumſtances, a great attraction to lead; though it does not retain any of that metal in cupellation, as gold does. If a mixture of ſilver and copper be melted with lead, in certain proportions, and the compound afterwards expoſed to a moderate fire, the lead and ſilver will melt out together, bringing very little of the copper with them: by this method, ſilver is often ſeparated from copper in the large works. The effect does not depend wholly upon the different fuſibility of the metals; for if tin, which is ſtill more fuſible than lead, be treated in the ſame manner, with a mixture of copper and ſilver, there will be no eliquation; the three ingredients here ſtrongly attracting one another, ſo as to come all into fuſion together. Again, if ſilver be melted with iron, and lead added to the mixture, the ſilver will forſake the iron to unite with the lead, and the iron will float by itſelf on the ſurface.

Precipitates or calces of ſilver melted with vitreous ſubſtances, impart to them a yellow colour. Kunckel obſerves, that when the glaſs is ſtrongly ſtirred in fuſion with an iron rod, or blown into veſſels, it changes its uniform tinge into an opaque milkineſs, variegated with yellow and other colours: the preparation of ſilver he employs is luna cornea. This, or the other precipitates, ſpread upon a glaſs plate, adhere and ſtain it yellow by ignition with fuſion: hence their uſe in painting on glaſs.

The moſt beautiful enamel for porcelane hitherto diſcovered, communicated in the Philoſophical Tranſactions, and the Swediſh Acts, owes its colour to ſilver. A glaſs made from three parts of litharge and one of flint, is reduced into groſs powder, and a ſolution of about one twentieth its weight of ſilver poured upon it: the mixture is ſtirred together, exſiccated and melted again, and when in thin fuſion poured out. This compoſition, ground into fine powder, is applied on the porcelane previouſly heated; and the ignition continued under a muffle, till the powder melts, which is known by its gliſtening. The ware is then taken out of the furnace, and, whilſt it continues red-hot, held over the ſmoke of burning vegetables, which calls forth the beautiful colour.

Silver is found in all countries; but moſt plentifully in America, particularly in Peru and Potoſi, from whence large quantities are brought annually into Europe. It is met with either in its perfect metallic ſtate, or in the form of ore, or blended in the ores of other metals.

Native malleable ſilver occurs not unfrequently in different ſtones, earths, and in moſt kinds of ſands, in ſmall pieces, of different figures, chiefly filaments or ſcales. It generally contains ſomewhat arſenical, but never holds any gold, though native gold is ſeldom free from ſilver.

The principal ores of ſilver are, 1° Ganſekothig ertz, gooſe-dung ore, ſo called from its colour; this is ſurrounded, and penetrated with effloreſcences of capillary ſilver. 2° Glaſſertz, compoſed of ſilver and ſulphur: this ore is of an irregular figure, ſometimes cubical, ſometimes of eight or more ſides. When pure, it may be hammered or cut almoſt like lead; but if penetrated by foreign matters, it falls in pieces from a blow; the pieces ſingly prove malleable. There are ſome ſorts brittle throughout, probably from an admixture of arſenic; its colour is blackiſh, ſometimes brighter and ſometimes darker: there is one ſort of a grey colour, almoſt like the fallow ore, but differing from that ore in containing no copper: it melts in the fire as ſoon as it begins to grow red-hot: its yield of ſilver is variable, but always large, amounting commonly to about three-fourths of its weight. 3° Hornertz, horn ore; externally irregular, internally compoſed of fine leaves laid together, and ſemi-tranſparent like horn. It yields like the foregoing both to the hammer and the knife: its colour is whitiſh, yellowiſh, or browniſh: it is commonly foul on the outſide, but may be eaſily diſtinguiſhed by cutting or bending it. In the fire it emits both an arſenical and ſulphureous fume, and commonly affords two thirds its weight of ſilver. 4° Rothgulden ertz, red ſilver ore, is ſometimes of a deep tranſparent red, and ſometimes darker: it is diſtinguiſhed from cinnabar by its colour inclining not to an aurora or brick red, but to the garnet or ruby red, or a purple red; though there are red ſilver ores alſo of a dull brick hue: the colour of cinnabar is improved, but that of the ſilver ores debaſed, by grinding them into fine powder. This ore is very ponderous, melts in the fire before it becomes red-hot, and emits thick fumes ſmelling ſtrongly of arſenic. It conſiſts of ſilver and arſenic, with a little ſulphur; and with theſe ingredients, or with equal parts of arſenic and native ſilver, it may be imitated by art. The quantity of ſilver in the deep red ſorts is commonly from ſixty to ſixty-two pounds on the hundred: the yield of the darker kinds is inconſtant: theſe laſt hold commonly a little iron. 5° Weiſſguldenertz, white ſilver ore, is of a bright grey colour, ponderous and brittle; when pure, it contains ſeven pounds of ſilver on the hundred, but a larger quantity of copper. It conſiſts of ſilver, copper, antimony, arſenic, and ſulphur: ſeveral ſorts contain likewiſe iron, and hold but very little ſilver, as two ounces on the hundred-weight; theſe are of a paler and brighter colour than the others, and called plain Weiſſertz, white ore. The white ſilver ores have a great reſemblance in colour to the paler cobalts; theſe laſt however are ſenſibly whiter, and incline a little, like biſmuth, to a reddiſh or yellowiſh caſt. 6° The Fahlertz and Fahlkuſſererts, fallow ore and fallow copper ore, are ranked among the ores of ſilver, though they belong more properly to thoſe of copper. Their colour is a dark grey; they are found among and ſometimes blended with copper ores and copper pyritæ: they hold from four ounces to ſome pounds of ſilver upon the hundred. 7° Federertz, feather ore, is compoſed of extremely fine fibres or hairs: it holds two ounces of ſilver on the hundred-weight, and contains both arſenic and ſulphur, for it yields on ſublimation a yellow arſenic. 8° Ruſs, ſooty ore, conſiſts of a fine ſoft black duſt, which is commonly lodged in clefts: it is very rich in ſilver, yielding ſometimes half its weight.

The method of extracting SILVER *from the Ore.*—In order to extract ſilver from the ore, they firſt break it into pretty ſmall pieces, and then grind it with iron peſtles, weighing about two hundred pounds, and which commonly are moved by water. The ore, when pounded, is paſſed through a ſieve of iron or copper, and then kneaded with water to a paſte, which they leave to dry a little; afterwards they knead it a ſecond time with ſea ſalt; and at laſt they throw ſome mercury upon it, and knead it a third time, in order to incorporate the mercury with the ſilver; being what they call an amalgama. Eight or ten days are ſufficient for this proceſs in temperate places; but in cold countries it ſometimes requires a month or ſix weeks: they then throw the paſte into large tubs or lavatories. In order to facilitate the operation, they conſtantly ſtir the paſte with their feet, that when the water

comes clear out of the baſons, there may remain at the bottom only ſilver and mercury amalgamated together; and this is what they call pigna. They endeavour to extract the mercury which is not incorporated with the ſilver, by preſſing the pigna, beating it ſtrongly, or bruiſing it in a preſs or mill. There are pignas of different ſizes and different weights; they commonly contain a third of ſilver, and two thirds of mercury. They lay the pigna upon a trevet, placing under it a veſſel full of water; and cover the whole with earth, in form of a cap, which they ſurround with burning coals. The action of the fire cauſes the mercury to evaporate from the pigna, and falls into the water, where it is condenſed. The interſtices which the mercury occupied in the pigna continue empty, and there remains only a porous and light maſs of ſilver, compared with its former bulk.

Silver is likewiſe extracted from the ore in the following manner: they firſt break the ore, and ſometimes waſh it, to ſeparate the ſtony particles which have been reduced to a powder: after this they calcine it, in order to extract from it the ſulphur and arſenic: this is what they call roaſting the ore; after which they waſh it again, to free it from the calcined powder. The ore being thus prepared, they fuſe it with lead or litharge, or with copel-heads that have been uſed before; they employ granulated lead for this purpoſe, when the work is but ſmall. The harder the ore is to melt, the more lead they mix with it, about fifteen or twenty parts of lead to one of ore. This proceſs is called ſcorifying: the ſcoriæ conſiſt of lead vitrified with the ſtone, and with whatever elſe is not gold or ſilver in the ore; and the metal precipitates into a regulus. If this regulus look pretty fine, and of a metallic colour, they put it into the copel; but, if it ſtill be mixed with ſcoriæ, and black, they melt it over again with a ſmall quantity of glaſs or lead.

In order to ſeparate the ſilver from the mercury, with which it is amalgamated, they have a furnace with an aperture at the top; this aperture they cover with a ſort of dome made of earth in a cylindrical form, which may be kept on or taken away at pleaſure. When they have put the maſs of ſilver and mercury into the furnace, laid on the cover, and lighted the fire, the quickſilver riſes in the form of vapours, and adheres to the dome, from whence they collect it, and uſe it again for the ſame purpoſe.

When the ſilver is well purified, ſo that all heterogeneous matter, either metallic or other, that might be mixed with it, is extracted, they ſay it is twelve carats fine. This is the expreſſion they uſe to denote the quality of the pureſt ſilver, without any mixture or alloy; but, if there ſhould remain any, they deduct the weight of the mixture from the principal weight, and the remainder ſhews the value of the ſilver. The carat conſiſts of twenty-four grains: ſo that, when to the weight of twelve carats there are twelve grains of mixture, the value of the ſilver is eleven carats twelve grains: and ſo of any other.

Refining of SILVER. See REFINING.

SILVER-LEAF, that beaten out into fine leaves for the uſe of the gilders, which is performed in the ſame manner as gold leaf.

Shell-SILVER, is made with ſilver leaf ground with new honey, and, after pouring a ſmall quantity of aqua fortis on it, the menſtruum is poured off, and the ſilver kept for uſe.

SILVERING, the covering of any thing with ſilver. It is uſual to ſilver metals, wood, paper, &c. which is performed either with fire, oil, or ſize. Metal-gilders ſilver by the fire; painter-gilders all the other ways.

To ſilver copper or braſs: 1. Cleanſe the metal with aqua-fortis, by waſhing it lightly, and immediately throwing it into fair water; or by heating it red-hot, and ſcouring it with ſalt and tartar, and fair water, with a ſmall wire-bruſh. 2. Diſſolve ſome ſilver in aqua-fortis, in a broad-bottomed glaſs veſſel, or of glazed earth, then evaporate away the aqua-fortis over a chaffing-diſh of coals. 3. Put five or ſix times its quantity of water, or as much as will be neceſſary to diſſolve it perfectly, on the remaining dry calx; evaporate this water with the like heat; then put more freſh water, and evaporate again; and if need be, the third time, making the fire towards the latter end ſo ſtrong, as to leave the calx perfectly dry, which, if your ſilver is good, will be of a pure white. 4. Take of this calx, common ſalt, cryſtal of tartar, of each a like quantity, or bulk, and mixing well the whole compoſition, put the metal into fair water, and take of the ſaid powder with your wet fingers, and rub it well on, till you find every little cavity of the metal ſufficiently ſilvered over. 5. If you would have it richly done, you muſt rub on more of the powder, and in the laſt place waſh the ſilvered metal in fair water, and rub it hard with a dry cloth.

SILVESTRE, or SYLVESTRE, *granum*, or *coccus* SYLVESTRIS, a term uſed by ſome authors, to expreſs the coccus Polonicus, and by others, for a coarſe or bad kind of cochineal, produced in the province of Guatimala, in New Spain: it is by ſome ſuppoſed to be the ſeed of the plant; but it is, in reality, a true inſect as the cochineal is; only that the ſcarlet colour it yields, is greatly inferior to the other.

SIMATIUM, or SIMAISE, in architecture. See CYMATIUM.

SINNA, the MONKEY. See the article MONKEY.

SIMILAR *Arches of a Circle*, are ſuch as are like parts of their whole circumferences.

SIMILAR *Bodies*, in natural philoſophy, are called ſuch as have their particles of the ſame kind and nature one with another.

SIMILAR *plane Numbers*, are thoſe numbers which may be ranged into the form of ſimilar rectangles: that is, into rectangles whoſe ſides are proportional, ſuch are 12 and 48; for the ſides of 12 are 6 and 2, and the ſides of 48 are 12 and 4. But 6: 2 :: 12: 4, and therefore thoſe numbers are ſimilar.

SIMILAR *Polygons*, are ſuch as have their angles ſeverally equal, and the ſides about thoſe angles proportional.

SIMILAR *Rectangles*, are thoſe which have their ſides about the equal angles proportional.

1. All ſquares are ſimilar rectangles.

2. All ſimilar rectangles are to each other as the ſquares of their homologous ſides.

SIMILAR *Right-Lined Figures*, are ſuch as have equal angles, and the ſides about thoſe equal angles proportional.

SIMILAR *Segments of a Circle*, are ſuch as contain equal angles.

SIMILAR *Conic Sections*. Two conic ſections of the ſame kind are ſaid to be ſimilar, when any ſegment being taken in the one, we can aſſign always a ſimilar ſegment in the other.

SIMILAR *Diameters of two Conic Sections*. The diameters in two conic ſections are ſaid to be ſimilar, when they make the ſame angles with their ordinates.

SIMILAR *Solids*, are ſuch as are contained under equal numbers of ſimilar planes, alike ſituated.

SIMILAR *Triangles*, are ſuch as have all their three angles reſpectively equal to one another.

1. All ſimilar triangles have the ſides about their equal angles proportional.

2. All ſimilar triangles are to one another as the ſquares of their homologous ſides.

SIMILAR DISEASE, in medicine, denotes a diſeaſe of ſome ſimple, ſolid part of the body; as of a fibre with regard to its tenſion or flaccidity; of a membrane; a nervous canal, or the like.

SIMILAR-PARTS, in anatomy, are thoſe parts of the body which at firſt ſight appear to conſiſt of like parts, or parts of the ſame nature, texture, and formation; of theſe we uſually reckon ten, viz. the bones, cartilages, ligaments, membranes, fibres, nerves, arteries, veins, fleſh, and ſkin. See BONE, CARTILAGE, &c.

SIMILE, or SIMILITUDE, in rhetoric and poetry, a compariſon of two things, which, though different in other reſpects, yet agree in ſome one.—As, "He ſhall be like a tree planted by the water-ſide, &c."

SIMILITUDE, in arithmetic, geometry, &c. denotes the relation of two things ſimilar to each other.

SIMONICAL, is applied to any perſon guilty of ſimony.

SIMONIANS,

SIMONIANS, in church hiſtory, a ſect of ancient heretics, ſo called from their founder Simon Magus, or the magician.

Simon Magus was a Samaritan, born in the village of Gitton. St. Philip the deacon, coming to preach at Samaria, converted ſeveral perſons there, and among the reſt this Simon, who believed, and was baptized. When the apoſtles St. Peter and St. John came to Samaria, and had conferred the Holy Ghoſt on ſuch as had been baptized by Philip, Simon, full of amazement at ſeeing the wonderful effects of the apoſtles impoſition of hands, offered them money, on condition they would give him the ſame power: for which he received a very ſharp and ſevere rebuke from St. Peter. The author of the Acts of the Apoſtles adds, that Simon had before addicted himſelf to the practice of magic, and by his impoſtures and enchantments had ſeduced the people of Samaria, who all followed him as a perſon endowed with a divine and ſupernatural power.

After St. Peter's reproof, and refuſal to ſell him the power of imparting the Holy Ghoſt, Simon fell into much great errors and abominations, applying himſelf to magic more than ever, and taking a pride in withſtanding the apoſtles. For this purpoſe he left Samaria, and travelled through ſeveral provinces, ſeeking out ſuch places where the Goſpel had not yet been preached, that he might prejudice the minds of men againſt it. At Tyre in Phœnicia, he bought a public proſtitute, named Selene or Helene, whom he carried about with him wherever he went, pretending ſhe was that Helen who had occaſioned the Trojan war.

Having run through ſeveral provinces, and gained the admiration of a vaſt number of perſons, he came to Rome, in the time of the emperor Claudius, about the year of Chriſt 41. It is ſaid, he was honoured as a god by the Romans, and that the ſenate decreed a ſtatue to be erected to him in the iſle of the Tyber, inſcribed To Simon The Holy. The fact however is diſputed by the beſt critics, who think that Juſtin Martyr miſtook an image of Semo Sanctus, a Pagan deity, for one erected to Simon Magus.

St. Peter, coming to Rome ſome time after the arrival of Simon Magus, ſoon reverſed all that the impoſtor had been doing there. However, Simon did not quit that city, but continued to ſpread his errors, and, under the reign of Nero, again acquired a great reputation by his enchantments. He pretended to be the Chriſt, and that he could aſcend into heaven. And we are told, he raiſed himſelf up into the air in a fiery-chariot, by the aſſiſtance of magic art. But St. Peter and St. Paul at the ſame time betaking themſelves to prayer, his charms failed him, and falling to the ground he broke his legs. Being carried to Brunduſium, he there threw himſelf from the top of the houſe where he lodged, and died on the ſpot.

The hereſies of Simon Magus were principally, his pretending to be the great power of God, and thinking that the gifts of the Holy Ghoſt were venal, and to be purchaſed with money. He is ſaid to have invented the Æons, which were ſo many perſons, of whom the Godhead was compoſed. His concubine Helen he called the firſt intelligence, and mother of all things; and ſometimes he called her Minerva, and himſelf Jupiter.

Simon Magus had gained a great number of followers, who embraced all the principles of their maſter, and indulged themſelves in all ſorts of vices and irregularities. They paid divine worſhip to Simon and Helen, offering to them victims and libations of wine. There is no doubt that, when St. John, St. Peter, and St. Paul, in their epiſtles, warn the Chriſtians againſt heretics, falſe apoſtles, and falſe teachers, the Simonians are principally intended. And indeed, as they were the earlieſt heretics, ſo were they the ſource of moſt of the other heretics, which ſoon after ſprung up in the church.

The ſect of the Simonians continued down to the fourth century. Origen tells us, they were reduced to about thirty perſons; and elſewhere, that they were quite extinct.

SIMONY, in eccleſiaſtical law, the crime of buying or ſelling ſpiritual gifts or preferments. In the antient Chriſtian church, this crime was always thought to be committed when men either offered or received money for ordinations. The apoſtolical canons lay a double puniſhment both of depoſition and excommunication, on ſuch of the clergy as were found guilty of it. This was the firſt ſort of ſimony, and that which was moſt properly ſo called; and to this the antients reduced the exacting of any reward for adminiſtering the euchariſt or baptiſm, or for any ſpiritual offices. A ſecond ſort of ſimony conſiſted in buying the ſpiritual perferments of the church; this was puniſhed with depoſition in any biſhop who promoted any church-officer for the ſake of lucre; and the perſons ſo promoted, were to be degraded from their office. By the laws of Juſtinian, every elector was to depoſe upon oath, that he did not chuſe the perſon elected for any gift or promiſe, or friendſhip, or any other cauſe, but only becauſe he knew him to be a man of the true catholic faith, of unblameable life, and good learning. This laſt ſort of ſimony was, when men by ambitious arts and undue practices got themſelves inveſted in an office or preferment to which they had no regular call, or when they intruded themſelves into other mens places, which were legally filled before. The caſuiſts for the church of Rome maintain, that all compacts or bargains in which benefices are concerned, are ſimonical, when it is done without the pope's concurrence; but that, once obtained, gives a ſanction to the thing, which they found upon this univerſal propoſition, that the pope cannot commit ſimony in beneficiary matters, ſince he hath a power ſo abſolute over all the eccleſiaſtical goods and benefices, that he can unite, divide, and beſtow them in whatever manner he pleaſes.

Againſt the corruption of ſimony, there have been many canons made in our own church, which puniſhes the offender with deprivation, diſability, &c. and by a ſtatute of the 31 Eliz. it is enacted, that if any perſon for any ſum of money, reward, gift, profit, or benefit, or by reaſon of any promiſe, agreement, grant, bond, covenant, or other aſſurance, ſhall preſent, or collate any perſon to any benefice with cure, dignity, or living eccleſiaſtical, every ſuch preſentation, or collation, and every admiſſion or induction thereupon, ſhall be utterly void, and the crown ſhall preſent for that turn; and the perſon that ſhall give or take any ſum of money, &c. ſhall forfeit double the value of one year's profit of any ſuch benefice; and the perſon ſo corruptly taking any ſuch benefice, ſhall from thenceforth be diſabled to have and enjoy the ſame.

SIMPLE, ſomething not mixed or compounded; in which ſenſe it ſtands oppoſed to compound.

Thus we ſay, ſimple form, ſimple mode, ſimple fee, ſimple force, ſimple equation, ſimple anomaly, ſimple glands, ſimple viſion, ſimple flank, ſimple fraction, &c.

Simple, in botany, is a general name given to all herbs and plants; as having each its particular virtue, whereby it becomes a ſimple remedy.

Simple Concords, are thoſe wherein we hear at leaſt two notes in conſonance; as a third and fifth; and, of conſequence, at leaſt three parts.

Simple Counter-point, is a harmonical compoſition, wherein note is ſet againſt note; in oppoſition to figurative counter-point.

SIMPLEX Beneficium, ſignifies an inferior dignity in a cathedral or collegiate church, a ſine-cure, penſion, or any eccleſiaſtical benefice, oppoſed to a cure of ſouls, and which therefore is conſiſtent with any parochial cure, without coming under the denomination of pluralities.

Simplifying, in eccleſiaſtical matters, is the taking away the cure of ſouls from a benefice, and diſpenſing the beneficiary from reſidence.

SIN, a breach or tranſgreſſion of ſome divine law, or command.

SINAPI, or Sinapis, muſtard, in botany, a genus of plants, the corolla of which conſiſts of four cruciform, roundiſh, plane, patent, and entire petals, with erect linear ungues, and ſcarcely the length of the cup; the fruit is an oblong, rough pod, conſiſting of two valves

valves, and containing two cells: the ſeeds are numerous and globoſe.

Muſtard-ſeed is an attenuant and reſolvent in a very high degree; it warms the ſtomach, and excites an appetite; but its principal medicinal uſe is external in ſinapiſms, applications made to certain parts when irritation is intended, but not bliſtering. It is uſually mixed with horſe-radiſh root, and other ingredients of the ſame kind, for this purpoſe.

SINAPISM, in pharmacy, is a cataplaſm of muſtard-ſeed applied with a view of exciting a heat and redneſs of the ſkin.

SINCIPUT, in anatomy, the fore-part of the head, reaching from the forehead to the coronal ſuture.

SINDON, in ſurgery, a little round piece of linen, ſilk, or lint, uſed in dreſſing a wound after trepanning.

SINE, or *right* SINE *of an Arch*, in trigonometry, is a right-line drawn from one end, or termination of an arch, perpendicular to the radius drawn to the other termination of the arch; being always equal to half the chord of twice the arch. Thus, S R, plate CXIX. *fig.* 1. is the right ſine of the arches S A and S D. See CIRCLE.

Whole SINE, *ſinus totus*, the ſine of 90 degrees, being equal to the radius or ſemidiameter.

SINE *Complement*, or *co*-SINE *of an Arch*, is that part of the diameter intercepted between the center and ſine, and is equal to the ſine of the complement of that arch. Thus C R is the co-ſine of the arch A S, and equal to H S, the ſine of its complement B S.

Verſed SINE *of an Arch*, is the part of the diameter intercepted between the ſine and the periphery. Thus, R A is the verſed ſine of A S, and of B S.

SINE-CURES, eccleſiaſtical benefices without cure of ſouls.

SINEW properly denotes what we call a nerve; though, in common ſpeech, it is rather uſed for a tendon.

SINGING, the action of making divers inflexions of the voice, agreeable to the ear, and correſpondent to the notes of a ſong, or piece of melody.

The firſt thing to be done in learning to ſing, is to raiſe a ſcale of notes by tones and ſemi-tones to an octave, and deſcend by the ſame notes; and then to riſe and fall by greater intervals, a third, fourth, fifth, &c. and to do all this by notes of different pitch. Then theſe notes are repreſented by lines and ſpaces, to which the ſyllables *fa*, *ſo*, *la*, *mi*, are applied, and the pupil taught to name each line and ſpace thereby; whence this practice is called *ſol-faing*.

SINGULAR NUMBER, in grammar, the firſt manner of declining nouns, and conjugating verbs; uſed when we only ſpeak of a ſingle perſon or thing.

The Latins, French, Engliſh, &c. have no number but the ſingular and plural; the Greeks and Hebrews have likewiſe a dual.

SINGULTUS, in medicine, a convulſive motion of the midriff, commonly called hiccup. See the article HICCUP.

SINICAL QUADRANT. See the article *Sinical* QUADRANT.

SINISTER, ſomething on, or towards, the left hand. Hence, ſome derive the word ſiniſter *a ſinendo*, becauſe the gods, by ſuch auguries, permit us to proceed in our deſigns.

SINISTER, in heraldry. The ſiniſter ſide of an eſcutcheon is the left hand ſide; the ſiniſter chief, the left angle of the chief; the ſiniſter baſe, the left hand part of the baſe.

SINISTER ASPECT, among aſtrologers, is an appearance of two planets happening according to the ſucceſſion of the ſigns, as Saturn in Aries, and Mars in the ſame degree of Gemini.

SINISTRI, a ſect of ancient heretics, thus called, becauſe they held the left hand in abhorrence, and made it a point of religion not to receive any thing therewith.

SINKING FUND, a proviſion made by parliament, conſiſting of the ſurpluſage of other funds, intended to be appropriated to the payment of the national debts; on the credit of which very large ſums have been borrowed for public uſes.

SINOPLE, or SENOPLE, in heraldry, denotes vert, or the green colours in armories.

SINUATED LEAF, in botany, a leaf which has a number of ſinuſes on its ſide, but thoſe ſeparated by lobes, not very long, nor themſelves indented, or notched at the edges. *Sinuato-dentated-leaf*, expreſſes a leaf like the former, but with the lateral lobes of a linear figure.

SINUOSITY, a ſeries of bends and turns in arches, or other irregular figures, ſometimes jetting out, and ſometimes falling in.

SINUOUS ULCER. See ULCER.

SINUS, in anatomy, denotes a cavity in certain bones, and other parts, the entrance of which is very narrow, and the bottom wider and more ſpacious. Of theſe ſinuſes we find ſeveral in divers parts of the body, particularly in the internal ſurface of the os occipitis; in adults, there is a croſs, to which adheres the ſinuſes and proceſſes of the dura mater, the uſe of which is to carry the blood from the brain, by a very peculiar mechaniſm, under the ſella equina, or turcica of the os ſphenoides; there is alſo a ſinus called the ſphenoidal ſinus; this is ſometimes double, and opens into the noſtrils; ſometimes it is totally wanting.

Sinus of an artery is uſed, by ſome, for any part of an artery where its ſides are ſtretched out beyond the ordinary proportional dimenſions elſewhere. Morgagni has obſerved four ſuch ſinuſes in the aorta, three of them anſwering to the ſemilunar valves; and the fourth is all that part of the aorta between the former ſinuſes, and the origin of the common trunk of the right ſubclavian and carotid arteries. Sinus of the womb is uſed for any cavity within its ſubſtance. See UTERUS.

SINUS, in ſurgery, a little cavity, or ſacculus, frequently formed by a wound or ulcer, wherein pus is collected.

A ſinus is properly a cavity in the middle of a fleſhy part, formed by the ſtagnation and putrefaction of the blood or humours, and which has wrought itſelf ſome vent or exit.

SIPHON, or SYPHON, in hydraulics, a bended pipe, one end of which being put into a veſſel of liquor, and the other hanging out of the ſaid veſſel over another, the liquor will run out from the firſt into the laſt, after the air has been ſucked out of the external or lower end of the ſiphon, and that as long as the liquor in the upper veſſel is above the upper orifice of the ſiphon. Thus, H D S, plate CXIX. *fig.* 2. is a ſiphon whoſe two parts H D, D S, are called its legs, and by its operation, the water is drawn out of the upper veſſel A B C D, into the lower *a b*. When you have ſucked out the air at S, the water follows, coming in at H, going in the direction H G D S, and out at S, as long as the ſurface E F is above I H; the level of the mouth of what is called the driving leg of the ſiphon, being that in which the water goes up, as that through which it goes down is called the iſſuing leg, and is always longer than the driving leg. Now, the cauſe of the ſiphon's running is this. The air which preſſes into the veſſel A B C D, repreſented by the column K L, ſuſtains the column of water L D, in the ſhort leg of the ſiphon, preſſing againſt that air with its perpendicular height D F, whilſt the column of air M S, preſſing upwards againſt the hole of the long or iſſuing leg D S, which acts according to the height D C, muſt yield and ſuffer the water to run out as long as the leg D S is longer, or rather higher in perpendicular than D G. For ſince K and M are ſuppoſed at top of the atmoſphere, the column K L and M S are equal in height and preſſure, the height of L above S being of no account in the height of the atmoſphere as long as M S is acted upon by the deſcending water D S, whoſe height is from D to S, ſuppoſe fifteen inches, an height ſuperior to that of the column D G, ſuppoſe of ſeven inches, ſupported by the column of air K L, the column M S muſt yield to the water iſſuing out at S; and however the ſurface of the water E-F deſcends, the column K L, by its preſſure, will always overcome the reſiſtance of the column M S, becauſe it has a leſs height of water to ſuſtain than M S has. If the mouth of the iſſuing leg had been at I, the water would hang in equilibrio, filling both legs of the ſiphon,

when

when the water is come down in the upper veſſel to I H T, becauſe then the two columns of air K L and M S will be acted againſt by an equal height of water in the legs of the ſiphon; but if then you raiſe the iſſuing end of the ſiphon, now ſuppoſed at T, up to the level of *u* V above I H, the water will run back up from V to D, and ſo out at H, in the upper veſſel, becauſe then the column M S having only the height V D to ſuſtain, will be acted againſt with leſs force than the column K L, which is preſſed againſt by the whole height D H, ſuperior to V D. See the articles FLUID, ENGINE, AIR, &c.

Since the preſſure of the air is the cauſe of the water being puſhed up into the ſiphon, and the difference of its preſſure, as one column is acted againſt by the water in the ſhort leg more weakly than another column of air is acted upon by the water in the long leg, is the cauſe of its running continually from one veſſel into another, when once ſet a-going, it follows, that the bend D of the upper part of the ſiphon muſt not be above thirty-two feet higher than the water in the upper veſſel, becauſe the air cannot ſuſtain a column of water, whoſe height exceeds thirty-two feet. If therefore there was a crane, or ſiphon, A C E D B (*fig.* 3.) of about forty feet high, reckoning from A to E, with cocks A and B at its lower ends, and an hole at the top E, to be ſtopped with a cork upon occaſion, there might be made the following experiment; water being poured into the veſſels A and B, let the cocks A and B be ſhut; then with a funnel pouring in water at E, till both legs of the ſiphon are full, ſtop the hole E, and open the two cocks at once. The water, inſtead of running from the veſſel A into B, which it would do if the height C A was much under thirty-two feet, will in the two legs fall back to C and D thirty-two feet above A and B, where it will hang, the air not being able to ſuſtain the water above thoſe heights, and conſequently to drive it up over the bend E. Nay, unleſs the water be purged of air before the experiment, the top of the water at C and D will not be quite thirty feet above the water in the veſſels A and B, becauſe air will extricate itſelf out of the water, and getting into the cavity C E D, preſs a little on the top of the water at C and D, ſo that its height will be leſs to ballance the preſſure of the atmoſphere.

Mercury will run in a ſiphon in the ſame manner as water, but then the bend of the ſiphon muſt not be more than thirty inches and eight tenths above the ſtagnant mercury in the upper veſſel; becauſe, as it is near fourteen times ſpecifically heavier than water, it will be lifted up by the preſſure of the air but the fourteenth part that water is lifted.

To prove further, that a different preſſure againſt the orifices of the unequal legs of a ſiphon, is the cauſe of a liquor running through that inſtrument from a higher into a lower veſſel, we may make uſe of any other fluid, lighter than the fluid to be brought over, inſtead of air, and leave the bend of the ſiphon open to the air, as in the following experiment: A B C D (*fig.* 4.) is a pretty large glaſs jar with a little water, tinged red to make the experiment the more conſpicuous, in its bottom, to the height of an inch, as at E F. On a ſtand between F and G in the great jar, there is placed a little jar, G H K I, almoſt full of the ſaid red water; let down the ſiphon S L M G, open at S, M, and G, into the veſſel, ſo that the end S of the long leg ſtands in the water at the bottom of the great jar; and G, the end of the ſhort leg in the little jar, at the bottom of its water; pour in oil of turpentine into the great jar up to L, ſo that the water in the little jar may alſo be covered with it, and the water will firſt riſe up in both legs of the ſiphon, ſo as to meet at the bend L, then it will run out of the little jar into the great one through the ſiphon, in the direction G H L S, as long as there is any water in the little jar above G.

Inſtead of hanging a ſiphon over the ſide of a veſſel, it may be adapted to a cup; ſo that the ſhort leg being in the cup, the long leg may go down through the bottom of the cup; and then it is called Tantalus's cup.

There are ſome ſiphons through which the water will run out of a veſſel without ſucking the air from them, or making them in the manner of a waſte pipe: but theſe muſt be made of capillary tubes whoſe bore muſt not be bigger than one tenth of a inch; and as ſoon as they are put into a veſſel of water T *s* S (*fig.* 5.) they will begin to run, and ſo continue as long as there is any water above the driving leg. This happens becauſe the attraction of coheſion, which makes water riſe up in ſmall tubes, draws the ſurface V to W in the ſiphon; where being lower than the ſurface of the water in the veſſel, it muſt run down; becauſe the column of water W S, is longer or higher than the column S V; and the air puſhing down at V, muſt overcome the reſiſtance of the air puſhing upwards at S. For the ſame reaſon, a piece of liſt of cloth, A D, will make the water come out of the veſſel and fall down in drops at E; as this piece of cloth is in effect a bundle of capillary ſiphons made by its interſtices. But if the ſurface of the water in the veſſel was at *g h*, the ſiphon being put in the water, would not run out, but only riſe in the ſiphon up to *e f*, the height to which a tube of that bore would raiſe the water by the attraction of coheſion. Whenever the veſſel is full, this experiment will ſucceed in vacuo.

SIRE, a title of honour in France, now given to the king only, as a mark of ſovereignty. In all placets and petitions, epiſtles, diſcourſes, &c. to the king, he is addreſſed under the title of ſire.

SIRE was anciently uſed in the ſame ſenſe with ſieur and ſeigneur, and applied to barons, gentlemen, and citizens.

SIREN, Σειρην, in antiquity, a mermaid; a name given to a kind of fabulous beings, repreſented by Ovid, &c. as ſea monſters with womens faces and fiſhes tails; and by others decked with a plumage of various colours. They are ſuppoſed to have been the three daughters of the river Achelous, and called Parthenope, Ligea, and Leucoſia. Homer only makes mention of two Sirens, but others reckon five. Virgil places them on rocks, where veſſels are in danger of ſplitting. Pliny makes them inhabit the promontory in Sicily, near cape Pelorus. Claudian ſays, they inhabited harmonious rocks; that they were charming monſters; and that ſailors were wrecked on their rocks without regret, and even expired in rapture. Artedi ſuppoſes it to conſtitute a peculiar genus of cetaceous fiſhes. The character he gives of it are the following: it has no pinnated tail; the head, neck, and breaſt, down to the navel, repreſent thoſe of the human ſpecies; there are only two fins on the whole body, and thoſe ſtand on the breaſt. Bartholine, in his Hiſtory of Curioſities, deſcribes ſuch a fiſh as this, under the name of Syrene, and Barchewitz under the name of homo marinus. This author ſays that he ſaw one at ſea, and that it is wholly different from the manati, and from all other fiſhes. The Philoſophical Tranſactions alſo contain an account of a ſea-man ſeen in the American ſeas, and ſeveral other writers of credit give countenance to the ſtory. Their deſcription tells us, that from the navel to the tail it is one ſhapeleſs maſs of fleſh, without any appearance of a finny tail, or any other part of the ſtructure of a fiſh. The pectoral fins reſemble hands, and are compoſed of five bones, or fingers, joined by a membrane. With theſe it ſwims. It were much to be wiſhed, that ſome accurate ichthyologiſt might have an opportunity of ſeeing and examining this creature, if it really exiſts different from the other animals of the ſea. Artedi ſeems to doubt the truth of the accounts, but thinks it better not to judge of a thing not yet ſeen, than to pronounce any thing raſhly againſt the accounts of creditable authors.

SIRIUS, in aſtronomy, the dog-ſtar; a very bright ſtar, of the firſt magnitude, in the mouth of the conſtellation canis major, or the great dog.

SISON, corn-parſley, or biſhop's-weed, in botany, a genus of plants, the general corolla of which is uniform: the partial corolla is formed of five equal lanceolated inflex petals: there is no pericarpium: the naked fruit is oval, ſtriated, and ſeparable into two parts: the ſeeds are two, oval, convex, ſtriated on one ſide, and plane and ſmooth on the other. The ſeed of this plant is one of the four leſſer hot ſeeds of the ſhops, and is an attenuant, aperient, and carminative. It is preſcribed in flatulencies

and colics, and againſt obſtructions of the menſes; and is ſaid alſo to be a lithontriptic.

SISTRUM, or CISTRUM, a kind of antient muſical inſtrument, uſed by the prieſts of Iſis and Oſiris. It is deſcribed by Spon as of an oval form, in manner of a racket, with three ſticks traverſing it breadth-wiſe, which playing freely by the agitation of the whole inſtrument, yielded a kind of ſound which to them ſeemed melodious. Mr. Malcolm takes the ſiſtrum to be no better than a kind of rattle. Oiſelius obſerves, that the ſiſtrum is found repreſented on ſeveral medals and on taliſmans.

SISYMBRIUM, water-creſſes, in botany, a genus of plants, the corolla whereof conſiſts of four cruciform, oblong, erecto-patent petals, oftentimes leſs than the cup, with a great number of ungues: the fruit is a long, crooked, cylindrical pod, conſiſting of two valves, and containing two cells: the ſeeds are numerous and ſmall.

The young leaves of this plant are frequently eaten in ſpring as a ſallad: the whole plant is of an acid taſte, and is a powerful attenuant and reſolvent. It is recommended as a kind of ſpecific in the ſcurvy, and is eaten in large quantities for that intention with great ſucceſs. It is good againſt obſtructions of the viſcera, and conſequently in jaundices, and many of the chronic diſeaſes. It is alſo a powerful diuretic, and promoter of the menſes: the beſt way of uſing it is in manner of a ſallad, or by drinking the expreſſed juice, which is at preſent much a cuſtom with us in ſpring with that of brook-lime, &c.

SITE, or SCITE, *Scitus*, denotes the ſituation of a houſe, meſſuage, &c. and ſometimes the ground-plot, or ſpot of earth it ſtands on.

In logic, ſitus is one of the predicaments declaring a ſubject to be ſo and ſo placed: and in geometry and algebra, it denotes the ſituation of lines, ſurfaces, &c.

SITOPHYLAX, in Grecian antiquity, an Athenian magiſtrate who had the ſuperintendance of the corn, and was to take care that nobody bought more than was neceſſary for the proviſion of his family.

The word is formed from the Greek, σιτος, corn, and φυλαξ, keeper.

SIUM, water-parſnip, ſkirret, and ninzin, in botany, a genus of plants, the general corolla of which is uniform: the partial one conſiſts of five inflex equal petals: the fruit is naked, and of an oval or roundiſh figure, ſmall, ſtriated, and ſeparable into two parts: the ſeeds are two, roundiſh, ſtriated, and convex on the one ſide, and plane on the other.

The leaves of this plant, eaten either crude or boiled, are ſaid to break and expel the ſtone; to excite urine and the menſes; to promote the expulſion of the fœtus; and to be good in a dyſentery.

SIXAIN, SIXTH, *ſexagena*, in war, an ancient order of battle, wherein ſix battalions being ranged in one line, the ſecond and fifth were made to advance, to form the van-guard; the firſt and ſixth to retire, to form the rear-guard; the third and fourth remaining on the ſpot, to form the corps, or body, of the battle.

The word is French, where it ſignifies the ſame thing.

SIXTH, *Sexta*, in muſic, one of the ſimple original concords, or harmonical intervals.

The ſixth is of two kinds, greater and leſs, and therefore is eſteemed one of the imperfect concords, though each of them ariſe from a different diviſion of the octave: the greater ſixth is a concord reſulting from the mixture of the ſounds of two ſtrings, that are to each other as 3: 5: the leſs from thoſe of two ſtrings, in the ratio of 5: 8.

The leſs ſixth is compoſed diatonically of ſix degrees, whence its name, and five intervals, three of which are tones, and two ſemi tones; chromatically of eight ſemitones, five of which are greater, and three leſs: it has its form, or origin, from the *ratio ſuper tri-partiens quinta*.

The greater ſixth is diatonically compoſed like the other, of ſix degrees and five intervals, among which four are tones, and one ſemi-tone; chromatically, of nine ſemi-tones, five of which are greater and four leſs; conſequently, it hath a leſs ſemi-tone more than the former. It has its origin from the *ratio ſuper bi partiens tertia*.

Anciently the ſixth had only one duplicate, which was the thirteenth; but in the modern ſyſtem of muſic it has the twentieth for its triplicate, the twenty-ſeventh for its quadruplicate, &c. every one of which are indifferently marked in thorough baſe by the figure 6. And even the ſixth itſelf both greater and leſs, when natural, is not expreſſed any otherwiſe, than by a ſimple 6: but when it is greater or leſs, by accident, the characters of ſharp or flat are ſet along with the 6.

Beſides theſe two kinds of ſixths, which are both good concords, there are two others that are vicious and diſſonant; the firſt, called the defective ſixth, compoſed of two tones and three ſemi-tones, or of ſeven ſemi-tones, five of which are greater, and two leſs; the ſecond is the redundant ſixth, compoſed of four tones, a greater ſemitone, and a leſs; whence ſome call it pentatonon, as comprehending five tones. Theſe two, being both diſſonant, ſhould never be uſed in melody, and very rarely in harmony.

As to the two conſonant ſixths, they were anciently uſed very ſparingly: at preſent they are allowed to be uſed as often as one pleaſes, as is the caſe with thirds: the ſixths being in reality no other than inverted thirds: but care is uſually taken that the firſt ſixth that occurs be a leſs, the laſt a greater; and from the greater we riſe to the octave; and from the leſs, fall to the fifth.

SIZE, the name of an inſtrument uſed to find the bigneſs of fine round pearls withal. It conſiſts of thin pieces or leaves, about two inches long and half an inch broad, faſtened together at one end by a rivet. In each of theſe are round holes drilled of different diameters. Thoſe in the firſt leaf ſerve for meaſuring pearls from half a grain to ſeven grains; thoſe of the ſecond, for pearls from eight grains, or two carats, to five carats, &c. and thoſe of the third, for pearls from ſix carats and a half to eight carats and a half.

SIZE is alſo a ſort of paint, varniſh, or glue, uſed by painters, &c,

The ſhreds and parings of leather, parchment, or vellum, being boiled in water and ſtrained, make ſize. This ſubſtance is uſed in many trades. Mr. Boyle mentions, among other uſes, that fine red ſtands and hanging ſhelves are coloured with ground vermilion tempered with ſize, and when dry are laid over with common varniſh. There is alſo a ſize made of iſing-glaſs, in the ſame manner, and for the like purpoſes; but this ſize will not keep above three or four days, ſo that no more ſhould be made of it at once than preſent occaſion requires.

The manner of uſing ſize is to melt ſome of it over a gentle fire, and ſcraping as much whiting into it as may only colour it, let them be well incorporated together; after which you may whiten frames, &c. with it. After it dries, melt the ſize again, and put more whiting, and whiten the frames, &c. ſeven or eight times, letting it dry between each time: but before it is quite dry, between each waſhing, you muſt ſmooth and wet it over with a clean bruſh-pencil in fair water.

To make gold-ſize take gum animi and aſphaltum, of each one ounce; minium, litharge of gold, and umber, of each half an ounce; reduce all into a very fine powder, and add to them four ounces of linſeed-oil, and eight ounces of drying-oil; digeſt them over a gentle fire that does not flame, ſo that the mixture may only ſimmer, but not boil; for fear it ſhould run over and ſet the houſe a-fire, keep it conſtantly ſtirring with a ſtick till all the ingredients are diſſolved and incorporated, and do not leave off ſtirring it till it becomes thick and ropy; and being boiled enough, let it ſtand till it is almoſt cold, and then ſtrain it through a coarſe linnen-cloth and keep it for uſe.

To prepare it for working, put what quantity you may have occaſion to uſe in a horſe-muſcle ſhell, adding ſo much oil of turpentine as will diſſolve it, and making it as thin as the bottom of your ſeed-lac varniſh; hold it over a candle, and then ſtrain it through a linnen-rag into another ſhell; add to theſe ſo much vermillion as will make it of a darkiſh-red: if it is too thick for drawing,

PLATE CXX.

Facing Skeleton.

Fig. 2.

Fig. 10.

Fig. 1.

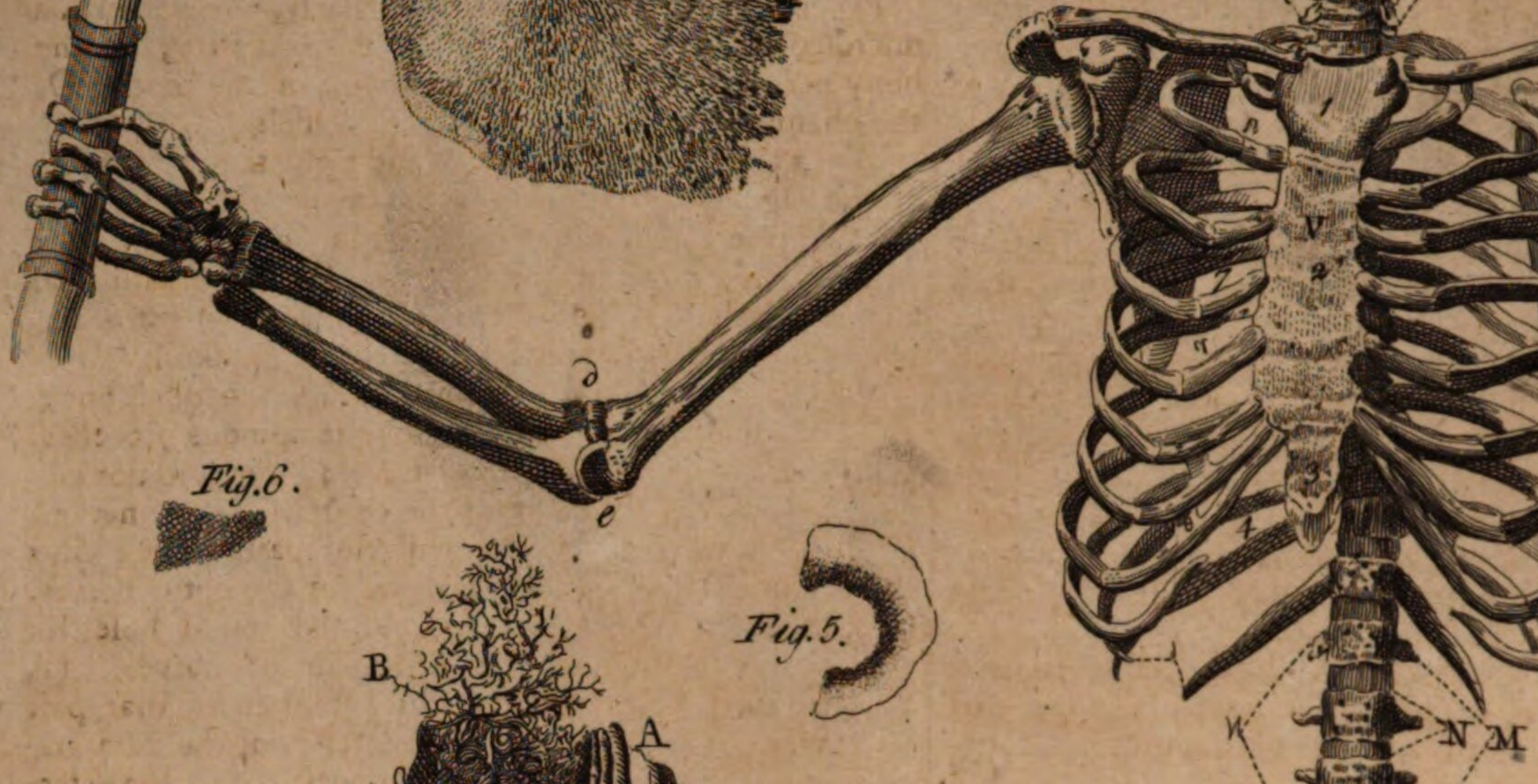


Fig. 11.

Fig. 6.

Fig. 5.

Fig. 7.

Fig. 4.

Fig. 19.

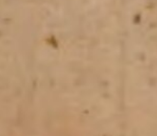


Fig. 8.

Fig. 12.

Fig. 13.

Fig. 17.

Fig. 14.

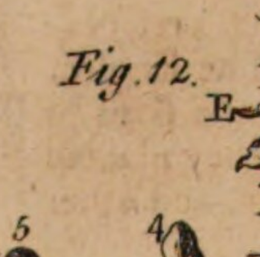


Fig. 18.

Fig. 9.

Fig. 15.

Fig. 16.

Fig. 20.

Fig. 3.

drawing, you may thin it with ſome oil of turpentine: The chief uſe of this ſize is for laying on metals.

The beſt gold-ſize for burniſhing is made as follows: take fine bole, what quantity you pleaſe, grind it finely on a marble, then ſcrape into it a little beef-ſuet: grind all well together; after which mix a ſmall proportion of parchment-ſize with a double proportion of water, and it is done.

To make ſilver-ſize: take tobacco pipe clay, in fine powder, into which ſcrape ſome black lead and a little Genoa-ſoap, and grind them all together with parchment-ſize, as already directed.

SKELETON, σκελετον, in anatomy, an aſſemblage or arrangement of all the bones of a dead animal, dried, cleanſed, and diſpoſed in their natural ſituation, and kept in that order by means of wires, &c.

The ſkeleton of the human body being of great uſe in learning its oſteology, we have given a figure of it in plate CXX. where *fig.* 1. repreſents part of the os frontis covered with its perioſteum, the arteries of which are injected. A, the branches which come from the orbit; the other ſmall trunks of the arteries to be obſerved in ſeveral places, are ſent from the common teguments to the perioſteum.

Fig. 2. The parietal bone of the human fœtus, to ſhew the radiated fibres of a flat bone proceeding from the firſt oſſified point A.

Fig. 3. The thigh-bone of a human fœtus, to ſhew the parallel fibres of a cylindrical bone. A, the part which firſt oſſifies. B B, the two extremities in a cartilaginous ſtate.

Fig. 4. A, A, A, A, the plates of the thigh-bone ſeparated. B, B, the cancelli.

Fig. 5. The tranſverſe ſection of a bone burnt till it is white, to ſhew the longitudinal canals of the bones.

Fig. 6. Marrow viewed with a microſcope.

Fig. 7. The thigh-bone ſawed longitudinally through the middle. B, B, the union of the bone with its epiphyſes.

Fig. 8. The os ilium ſawed through the middle.

Note, by comparing *fig.* 7 and 8, the different internal ſtructure of round and broad bones is ſeen.

Fig. 9. A, the head of the thigh-bone of a child. B, the round ligament connecting it to the acetabulum. C, the circular ligament with its arteries injected. D, the numerous veſſels of the mucilaginous gland injected.

Fig. 10. The ſkeleton of a man. A, the frontal bone; B, the parietal bone; C, the temporal bone; D, the occipital bone; E, the bones of the noſe; F, the os malarum; G, the ſuperior maxillary bone; H, the lower jaw; I, the teeth; K, the ſeven vertebræ of the neck, with their cartilages between them; L, L, L, &c. the twelve vertebræ of the back; M, the five vertebræ of the loins; N, the cartilages between the vertebræ of the loins; O, the os ſacrum; P, the os coccygis; Q, the os ilium; R, the os pubis; S, the os iſchium; T, the ſeven true ribs; U, the five falſe ribs; V, the ſternum; X, the clavicles; Y, the ſcapula; Z, the humerus, or arm-bone; a, the ulna; b, the radius; c, the carpus; d, the metacarpus; e, the phalanges digitorum; f, the thigh-bone; g, the rotula; h, the tibia; i, the fibula; k, the tarſus; l, the metatarſus; m, the phalanges of the toes; *a*, the head of the radius; *b*, the head of the ulna; *c*, the bones of the carpus; *d*, the lower appendix, which receives the head of the radius; *e*, the lower appendix, which receives the head of the ulna; *f*, the upper head of the os femoris, which is received into the acetabulum or coxendix; *g*, the outer trochanter; *i*, the trochanter minor; *k*, *l*, the two lower heads of the thigh-bone; *p*, the head of the tibia.

Fig. 11. A view of the lower part and ſide next the noſe of the left os maxillare, with the palate-bone, and os turbinatum inferius. γ, the naſal proceſs. δ, the great tuber. ε, the palate-plate. ζ, the naſal ſpine. η, the orifice of the antrum maxillare. κ, the os ſpongioſum or turbinatum inferius. λ, the two dentes inciſores. μ, the caninus. ν, the five dentes molares.

Fig. 12. The palate-bone. A, the ſuperior ſide of its palate-plate. B, its poſterior edge. C, the anterior edge. D, the naſal ſpine; *i*, the naſal plate. H, the ridge on which the os ſpongioſum inferius reſts. E, the proceſs applied to the ſphenoid bone. F, the orbiter proceſs.

Fig. 13. A view of the ſurface next to the mouth of the right ſide of the lower jaw; 1, the ſubſtance in the middle of the chin; 2, the baſe of the jaw; 3, the angle; 4, the corone; 5, the condyle; 6, the rough print of the internal pterygoid muſcle; 7, the entry of the channel for the nerve and blood veſſels; 8, the five grinders.

Fig. 14. A tooth cut perpendicularly, viewed with a microſcope; A, the fibres of the cortical part; B, the bony part; C, the entry at the point of the root to D, the channel for the nerve and blood-veſſels.

Fig. 15. The internal ſide of the right temporal bone. *b*, the edge which forms the ſquamous ſuture. *c*, the prints of the convolutions of the brain. *d*, the mammary part. *e*, the ridge of the os petroſum. *f*, the internal auditory hole. *g*, the extremity of the os petroſum, where the internal carotid artery enters the ſkull.

Fig. 16. An internal view of the ſphenoid bone. 1, 1, the wings. 2, 2, the tranſverſe ſpinous proceſſes. 3, 3, the anterior clinoid proceſſes. 4, the poſterior clinoid proceſs. 5, the print of the conjoined optic nerves. 6, the ſella turcica. 7, the poſterior part, which joins the occipital bone. 8, 8, the holes for the optic nerves. 9, 9, the foramina lacera. 10, 10, the round holes for the ſecond branch of the fifth pair of nerves. 11, 11, the oval holes for the third branch of that pair of nerves. 12, the holes for the arteries of the dura mater. 14, the internal pterygoid proceſs. 15, the external pterygoid proceſs.

Fig. 17. An exterior view of the ethmoid bone. E, the criſtagalli. F, the naſal plate. G, the right ſuperior os turbinatum. H, the right os planum. L, the poſterior part which is joined to the ſphenoid bone.

Fig. 18. A poſterior view of the two naſal bones. A, their ſuperior ſides. B, their exterior ſides. C, their inferior ſides.

Fig. 19. The ſide of the os unguis next the noſe. A, the orbiter part. B, the lacrymal part. C, the furrow between thoſe two convex parts.

Fig. 20. A poſterior view of the left os malarum. A, the orbiter proceſs. B, the inferior orbiter proceſs, C, the malar proceſs. D, the zygomatic proceſs. E, the internal orbiter proceſs. F, the hollow made by the temporal muſcle.

SKIN, *Cutis*, in anatomy. See the article CUTIS.

SKIN, in commerce, is particularly uſed for the membrane ſtripped off the animal to be prepared by the tanner, ſkinner, currier, parchment maker, &c. and converted into leather, &c.

Skins and the hair of beaſts manufactured become parchment and vellum; leather, of which are made ſhoes and boots, ſaddles, harneſſes, and furniture for horſes, gloves and garments, coaches and chairs, houſhold-ſtuff, covers of books, drinking veſſels, &c. and furs for cloathing, hats, caps, &c. Thoſe branches of trade that are derivable from the ſkin-trade, render it a very great mercantile concern, and well deſerving preſervation as much as we can within ourſelves. The Engliſh have greatly increaſed their quantity of furs and ſkins of all ſorts from their northern colonies, ſince they planted northward towards Nova-Scotia, Annapolis, and other places towards the river Canada.

The ſeveral ſorts of ſkins brought to Europe from thoſe parts are the following kinds, viz. deer-ſkins, bear, beaver, otter, racoon, fox, elk, cat, wolf, martin, mink, muſqueſh, fiſher, &c.

The Indians in Carolina and Virginia dreſs buck and doe ſkins in this manner: the felt being taken off, they ſtrain them with lines, or otherwiſe, much like the clothiers racks, in order only to dry them. When the hunting time is over, the women dreſs the ſkins, by putting them in a pond, or hole of water, to ſoak them well; then with an old knife, fixed in a cleft ſtick, they force off the hair, whilſt they remain wet. This done, they put them into a kettle, or earthen-pot, and a proportion of deer's brains, dried and preſerved for this purpoſe, is put in along with them; this veſſel is ſet on the fire till they are more than blood-warm, which will make

make them lather and ſcour clean; after this, with ſmall ſticks, they wreſt and twiſt each ſkin as long as they find any wet to drop from them, letting them remain ſo wreſted for ſome hours; and then they untwiſt and ſtretch each of them in a ſort of a rack, ſo that every part is extended: and, as the ſkin dries, they take a dull hatchet, or ſome ſuch inſtrument, and rub them well over, to force all the water and greaſe out of them, till they become perfectly dry, and then their work is done.

In this manner one woman, for the men never employ themſelves in this work, will dreſs eight or ten ſkins in a day, that is, begin and finiſh them.

SKINNER, one who works and deals in ſkins.

SKIRMISH, in the art of war, a diſorderly kind of combat, or encounter, in preſence of two armies, between ſmall parties, or perſons, who advance from the body for that purpoſe, and introduce to a general and regular fight.

SKULL, *Cranium et Calvaria*, in anatomy, that part of the head which forms its great bony cavity; and in a living ſubject contains the brain.

The ſhape of the ſkull is oval: its exterior ſurface is convex: and its interior, concave; its round figure is an advantage to its capacity: it is a little depreſſed and longiſh, advancing out behind and flatted on the two ſides that form the temples, which contributes to the enlargement of the ſight and hearing: it is of unequal thickneſs in the ſeveral parts, and is compoſed of two lamellæ, or tables, an exterior and interior, laid or applied over each other, between which there is a diploë, or meditullium, being a thin ſpongious ſubſtance, made of bony fibres detached from each lamina, and full of little cells of different bigneſſes: the tables are hard and ſolid, the fibres being cloſe to one another: the diploë is ſoft, in regard the bony fibres are here at a greater diſtance; a contrivance whereby the ſkull is not only made lighter, but leſs liable to fractures; the external lamina is ſmooth, and covered with the pericranium: the internal is likewiſe ſmooth, abating the furrows made by the pulſation of the arteries of the dura mater before the cranium be arrived at its conſiſtence: it has ſeveral holes, thro' which it gives paſſage to the ſpinal marrow, nerves, arteries, and veins, for the conveyance and reconveyance of the blood, &c. between the heart and the brain.

The bones of the ſkull are eight, viz. the os frontis, the two parietal bones, the two bones of the temples, the occipital, the ſphenoides, and the ethmoides; each of which are deſcribed under their ſeveral names.

All the bones of the cranium are found to be imperfect in new-born infants: the ſinus and its meditullium are almoſt wholly wanting; the bony fibres in the formation of almoſt all of them, are carried in form of rays from a center towards the circumference; and moſt of them are not ſingle, as in adults, but compoſed each of ſeveral fruſtules, or little pieces; nor are the ſutures at that time formed, and frequently there are triquetrous little bones between them.

In adults the ſeveral bones of the ſkull are in general joined by ſutures: theſe ſutures are either common or proper; the proper ſutures are diſtinguiſhed into the true and the falſe or ſpurious; they are called true ſutures when the bones are joined together by means of a multitude of unequal denticulated eminences, forming an appearance ſomewhat like the edge of a ſaw: theſe denticulations enter mutually into each other's ſinuſes, and on the outſide are moſt plainly viſible: of this kind are thoſe called the coronal, ſagittal, and lambdoidal ſutures.

The falſe or ſpurious ſutures are thoſe ſquamoſe ones of the temporal and parietal bones, and of the os frontis and ſphenoides, in the angle where they unite with the parietal ones. The common ſutures are the tranſverſal one, which joins the os frontis with the bones below it, the ſphenoidal, the ethmoidal, and the zygomatic; but theſe are of little moment. Some authors mention the having met with ſkulls in which there were no ſutures at all. Between the ſutures, particularly the lambdoidal and ſagittal, there are found, in many ſkulls, certain ſmall bones; theſe are called, by ſome, oſſa triquetra, from their figure; by others, oſſa wormiana: they are uncertain in their figures and ſituation, and are joined to the others by ſutures: theſe bones are by ſome eſteemed a great medicine in epilepſies.

The uſe of the ſutures is, 1. That the dura mater may in thoſe parts be very firmly joined to the cranium and pericranium. 2. That, in infants, the head may the more eaſily be extended in its growth from the ſeveral bones being at that period diſunited at theſe places. 3. That the tranſpiration from the brain may be the more free and eaſy at that time of life in which they are open, and at which alſo the habit is more humid. 4. That very large fractures of the ſkull might in ſome meaſure be prevented: and finally, there is another advantage in their openneſs in children; namely, that medicinal applications to the external part of the head may penetrate and do ſervice.

The foramina in the cranium are numerous, and their uſes important: theſe are divided into the external and internal: by the external are meant thoſe which are eaſily diſcovered on the external ſurface of the ſkull; and by the internal are meant thoſe which are moſt obvious in the internal ſurface. Of the larger internal foramina we count eleven pair, affording paſſage to the arteries, veins, and nerves of the brain; beſides theſe, we are to remark one which is ſingle, namely, the great foramen of the occipital bone, that gives paſſage to the medulla ſpinalis, and with it to the acceſſory ſpinal nerves, and to the vertebral arteries. Particular regard is to be had to the firſt pair of theſe foramina, which may indeed be more properly called a congeries of the foramina of the os cribroſum; theſe give paſſage to the filaments of the firſt pair of nerves, called the olfactory nerves: the ſecond pair are in the ſphenoidal bones, and give paſſage to the optic nerves: the third pair are called the unequal and lacerated foramina, and give paſſage to the third and fourth pair of the nerves, to the firſt branch of the fifth pair, and to the ſixth pair; as alſo to the emiſſary of the receptacles of the dura mater: the fourth pair are in the ſphenoidal bone, and give paſſage to the ſecond branch of the fifth pair of nerves, which is diſtributed to the ſeveral parts of the upper jaw: the fifth, or oval foramina, give paſſage to the third branch of the fifth pair, and to the emiſſary of the dura mater: the ſixth is a very ſmall foramen, and admits of an artery, which is diſtributed over the dura mater, and is that which forms the impreſſions of little ſhrubs or trees on the parietal bones: the ſeventh is placed between the ſella equina and the petroſe apophyſis, and it tranſmits no veſſels, but is ſhut up by the dura mater: the eighth pair of foramina give paſſage to the carotid arteries, whence it is called the carotid foramen; and the intercoſtal nerve has its egreſs alſo at this opening: through the ninth, which is in the os petroſum, paſſes the auditory nerve: through the tenth, which is between the os petroſum and the occipital bone, paſs the par vagum and the lateral ſinuſes of the dura mater, together with the ſpinal nerve: the eleventh is in the os occipitis, near the edge of the foramen magnum; and through this paſs the ninth pair of nerves, called the linguale.

Beſides theſe foramina, there are a number of little ones in the os petroſum, often very viſible; one of theſe carries back a branch of the auditory nerve to the dura mater; and the other principal one tranſmits the ſanguiferous veſſels to the labyrinth, or the internal organ of hearing. See the article EAR.

Of the external foramina, there are two proper ones of the os frontis, a little above the orbits; theſe are, from their ſituation, called ſupra orbitalia: they give paſſage to the ophthalmic nerve of Willis. Beſides theſe, there are four other foramina common to the os frontis, and to the plane or papyraceous bones of the orbit; two of theſe are placed on each ſide, and they tranſmit little nerves and veſſels to the ſinus of the ethmoidal bone. In the parietal bone there is one, which ſerves for the paſſage of a vein from the cutis of the cranium into the ſagittal ſinus of the dura mater, or from the ſagittal ſinus to the external veins of the head; but this is often wanting. In each of the oſſa temporum there are three common foramina; the firſt of theſe is the foramen jugale, which ſerves for the paſſage of the crotaphite-muſcle; the ſecond is large, in which is the ſinus of the jugular vein; and the third is the ductus Euſtachii, ſituated be-

tween

tween the petroſum and the ſphenoides, and leading from the mouth into the internal ear. Beſides theſe common foramina of the oſſa temporum, there are alſo three proper ones: 1. The meatus auditorius. 2. The aquæduct of Fallopius, ſituated between the maſtoide and ſtyloide proceſs, and tranſmitting the hard portion of the auditory nerve. 3. A foramen behind the maſtoide proceſs, ſerving for the ingreſs of a vein into the lateral ſinus, or for the egreſs of one from the lateral ſinus into the veins of the occiput. In the occipital bone there are two foramina, ſituated behind the condyloide apophyſes, and ſerving to give paſſage to the vertebral veins, into the lateral ſinuſes of the dura mater: theſe, however, are wanting in many ſkulls. In the ſphenoides, beſides the internal ones already deſcribed, are the apertures of the ſinuſes into the noſtrils, common to them with the bones of the palate, and which are the apertures of the nares and fauces: there is another canal in the upper part of the pterygoide proceſſes, ſerving for the paſſage of the novum emiſſarium of the dura mater. In the os ethmoides there are, 1. Thoſe common to this bone with the os frontis, ſituated in the interior ſide of the orbit, and already deſcribed. And, 2. The apertures of the ethmoidal ſinuſes into the noſtrils. In the examination of different ſkulls, other foramina, beſides theſe, will occaſionally be found in different places; but theſe are either extraordinary and luſus naturæ, as is often the caſe; or they are otherwiſe ſuch as ſerve only to give paſſage to veſſels ſerving for the nutrition of the bones in which they ſtand.

Concealed Injuries and Wounds of the SKULL. When a blunt inſtrument is the occaſion of any injury of the cranium, if the injured part does not ſufficiently appear of itſelf, great induſtry is neceſſary to diſcover it. Where the common integuments appear tumid and ſoft, they are in this caſe to be divided to the bone; but in making the inciſion, care muſt be taken not to lay too much ſtreſs upon the knife, leſt ſplinters of the fractured cranium ſhould, by that means, be forced upon the brain. The beſt way to make this inciſion, according to Heiſter, is in form of the letter X, and about an inch and half in length, lifting up the ſkin at each angle, and leaving the bone bare. The blood that is ſpilt, may be taken up by a ſponge, and dry lint ſtuffed between the ſkin and the cranium: and having thus found out the injured part of the cranium, the trepan is to be applied, if it be found neceſſary. If ſplinters of the bone are now found, they muſt be removed either with the fingers or forceps, or, when they hang to the pericranium, with ſciſſars; but when they adhere pretty firmly to the neighbouring parts of the cranium, it is more adviſeable to replace them, than to endeavour to remove them by violence.

In wounds of the cranium, or ſkull, the firſt buſineſs is to find whether they are terminated in the external parts of the cranium, or whether they penetrate into its cavity: this is to be known, 1. By the eye. 2. By the probe; which, however, muſt be gently uſed here, for fear of bringing on farther miſchief. 3. By examining the inſtrument with which the blow was given, and conſidering the degree of force with which it was impelled. And, laſtly, the preſence or abſence of very bad ſymptoms: for a violent blow upon the head will always be attended with vomitings and vertigos, and blood will be diſcharged from the noſe, ears, and mouth, and the wounded perſon will loſe his ſpeech and ſenſes. Theſe diſorders will appear, ſometimes ſooner and ſometimes later, but are always moſt violent, when the wound is by a fall, or by ſome blunt inſtrument; in which caſes the cranium is uſually much ſhattered. The blood which diſcharges itſelf by the wound, that is made by a ſharp inſtrument, will inſinuate itſelf between the common integuments and the cranium: in the contuſions that are made with blunt inſtruments, ſometimes it will be concealed under the cranium; and, by corrupting the perioſteum and the cranium, will bring on ulcers and caries of the bone, and frequently occaſions fevers, convulſions, and death.

SKY, the blue expanſe of air, or atmoſphere.

Sir Iſaac Newton attributes the azure colour of the ſky to vapours beginning to condenſe therein, which have attained conſiſtence enough to reflect the moſt reflexible rays, viz. the violet ones; but not enough to reflect any of the leſs reflexible ones. M. de la Hire attributes it to our viewing a black object, viz. the dark regions beyond the limits of the atmoſphere, through a white or lucid one, viz. the air illuminated by the ſun: a mixture of black and white always appearing blue. But this conjecture is not originally his, being as old as Leonardo da Vinci.

SKY-COLOUR. To give this colour to glaſs, ſet in the furnace a pot of pure metal of frit from rochetta, or barillia, but the rochetta frit does beſt; as ſoon as the metal is well purified take for a pot of twenty pounds of metal ſix ounces of braſs calcined by itſelf; put it by degrees, at two or three times, into the metal, ſtirring and mixing it well every time, and diligently ſcumming the metal with a ladle: at the end of two hours the whole will be well mixed, and a proof may be taken; if the colour be found right, let the whole ſtand twenty-four hours longer in the furnace, and it will then be fit to work, and will prove of a moſt beautiful ſky-colour.

SLAB, an outſide ſappy plank or board ſawed off from the ſides of a timber-tree: the word is alſo uſed for a flat-piece of marble.

SLABS *of Tin*, the leſſer maſſes, which the workers at the tin mines caſt the metal into: theſe are run into moulds made of ſtone.

SLACKEN, in metallurgy, a term uſed by the miners to expreſs a ſpongy and ſemi-vitrified ſubſtance, which they uſe to mix with the ores of metals, to prevent their fuſion. It is the ſcoriæ or ſcum, ſeparated from the ſurface of the former fuſions of metals. To this they frequently add lime-ſtone, and ſometimes a kind of coarſe iron-ore, in the running of the poorer golden ores.

SLATE, a bluiſh foſſile ſtone, very ſoft when dug out of the quarry, and therefore eaſily cut or ſawed into thin long ſquares, to ſerve inſtead of tiles for the covering of houſes; alſo for making tables, &c.

The ancients were unacquainted with the uſe of ſlate, inſtead of which they covered their houſes with ſhingles, as we read in Pliny. Beſides the blue ſlate we have alſo in England a greyiſh ſlate, called alſo Horſham ſtone, from a town in Suſſex of that name, where the greateſt quantities of it are found.

The blue ſlate is very light and laſting, but chargeable withal, becauſe the roof muſt be firſt boarded over, the ſlates hung with tacks, and laid with finer mortar than tiles. The grey ſlate is chiefly uſed in covering churches, chancels, &c.

SLAVE, a perſon in the abſolute power of a maſter, either by war or conqueſt.

Menage and Voſſius derive the word from *Sclavis*, the name of a Scythian people, whom Charlemagne condemned to perpetual impriſonment; whence the Italians formed their *ſchiavo*, the Germans their *ſchlave*, the French their *eſclave*, and we *ſlaves*.

SLAUGHTER. See the articles MAN-SLAUGHTER, HOMICIDE, &c.

SLAUGHTER-SKINS, a term uſed by our curriers and leather-dreſſers for the ſkins of oxen, or other beaſts, when freſh, and covered with the hair: ſuch as they receive them from the ſlaughter-houſes, where the butchers flay the carcaſe.

SLEDGE, a kind of carriage without wheels, for the conveyance of very weighty things, as huge ſtones, &c.

This is alſo the name of a large ſmith's hammer, to be uſed with both hands. Of this there are two ſorts; the uphand-ſledge, which is uſed by under-workmen, when the work is not of the larger ſort; it is uſed with both the hands before, and they ſeldom raiſe it higher than their head; but the other, which is called the about-ſledge, and which is uſed for battering or drawing out the largeſt work, is held by the handle with both hands, and ſwung round over their heads at their arm's end, to ſtrike as hard a blow as they can.

SLEEP, that ſtate wherein the body appearing perfectly at reſt, external objects move the organs of ſenſe as uſual, without exciting the uſual ſenſations.

Every one knows that in ſleep there is a ceſſation from action. When waking, we walk, diſcourſe, move this or that limb, &c. but, in natural and undiſturbed reſt, there is nothing of all theſe; that is, whereas, being awake,

awake, we perform ſeveral motions by the voluntary contraction of our muſcles; when aſleep, thoſe muſcles only are contracted, whoſe action is, in a manner, involuntary, or to which the mind has always ſo conſtantly determined the ſpirit, that it does it by a habit, without the intervention of the reaſoning faculty; ſuch are thoſe of the heart and breaſt. So that there is, at this time, a relaxation or looſeneſs of the moving fibres of the ſeveral members, or, at leaſt, ſuch a quiet poſition and ſtate of them, by which all the antagoniſt muſcles are in an æquilibrium and equality of action, not overpowering one another. For this, indeed, ſeems to be one great deſign of ſleep, to recover to the parts overſtretched with labour their former tone and force; and, therefore, we do naturally, when compoſing ourſelves to reſt, put our body into that poſture which moſt favours the particular wearied limbs, and conduce to this end.

In the next place, it is very plain that there is in ſleep, not only a reſt and ſuſpenſion from acting of moſt of our bodily organs, but even of our thinking faculty too; that is, to prevent cavils, a ceaſing from ſuch thoughts as when waking we are exerciſed about, which we do reflect upon, and will, to employ our mind with: for, though dreams are thoughts, yet they are but imperfect and incoherent ones, and are, indeed, either ſo faint and languid repreſentations, as to be conſiſtent with our ſleep, as ſome may be; or elſe, if they be ſtrong and lively, they are, as every one knows, the interruption and diſturbance of it.

From hence it will follow, that the motion of the arterial fluid muſt be, cæteris paribus, more ſedate, even, and regular in the time of ſleeping, than waking; for, beſides the various alterations which, in the latter ſtate, this receives from the ſeveral paſſions of the mind, the very contractions of the muſcles themſelves, in exerciſes of the body, do differently forward its courſe; whereas, in ſleep, the force of the heat and pectoral muſcles, being more conſtant and uniform, gives it a more calm and equally continued impulſe.

Hence, alſo, it will come to paſs, that the influx of the liquor of the nerves into the organs of the body, as alſo its reflux towards the brain, is, in ſleep, either none, or very inconſiderable; that is, that this fluid has, at this time, but little or no motion: for it is muſcular action and ſenſation that require it to be thus determined, this way or that, which are now hardly any: and yet, by the arrival of the blood at the brain, this juice will ſtill be ſeparated there, fit to be derived into its canals or tubes: ſo that, by this means, there will be a kind of accumulation, or laying up in ſtore of ſpirits for the offices and requirements of waking.

Thus we may, in ſhort, look upon this time as the time of wearing out, or the deſtruction of the animal fabric; and the time of ſleep, as that in which it is repaired and recruited; and not only on the account we have juſt mentioned concerning the nervous liquor, but alſo with reſpect to all the other parts, as well fluid as ſolid; for action does neceſſarily, by degrees, impair the ſprings and organs; and in motion ſomething is continually abraded and ſtruck off from the diſtractile fibres, which cannot be otherwiſe reſtored, than by their being at reſt from tenſion. Beſides that, ſuch a regular and ſteady courſe of the blood as we have obſerved to be in ſleep, is by far more fit and proper for nutrition, or an appoſition of parts to the veſſels, which an uneven hurry of it is more apt to tear off and waſh away.

SLEEPER, or the GREAT SLEEPER, in zoology, the hairy-tailed mus with red feet.

This animal is of the ſize of the rat, but more corpulent; the head is ſhort and thick; the opening of the mouth ſmall; the noſtrils fleſh-coloured; the eyes large, black, and prominent; and the ears large and naked. It is frequent in many parts of Europe, and retires in winter into caverns under the ground, where it carries however a conſiderable ſtore of nuts and other fruits.

SLEEPERS, in natural hiſtory, a name given to ſome animals which ſleep all the winter: ſuch are bears, marmotes, dormice, bats, hedge-hogs, ſwallows, &c. Theſe do not feed in winter; have no ſenſible evacuations, breathe little, or not at all, and moſt of the viſcera ceaſe from their functions. Some of theſe creatures ſeem to be dead, and others to return to a ſtate like unto that of the fœtus before birth. In this condition they continue, till by length of time maturating the proceſs, or by new heat, the fluids are attenuated, the ſolids ſtimulated, and the functions begin where they left off.

SLEEPERS, in the glaſs trade, are the large iron bars croſſing the ſmaller ones, and hindering the paſſage of the coals, but leaving room for the aſhes.

SLICH, in metallurgy, the ore of any metal, particularly of gold, when it has been pounded, and prepared for farther working.

SLIDING, in mechanics, is when the ſame point of a body, moving along a ſurface, deſcribes a line on that ſurface.

SLIDING *Rule*. See RULE.

SLING, *Funda*, an inſtrument ſerving for caſting ſtones with great violence. The inhabitants of the Balearic iſlands were famous in antiquity, for the dexterous management of the ſling: it is ſaid they bore three kinds of ſlings, ſome longer, others ſhorter, which they uſed according as their enemies were either nearer or more remote. It is added, that the firſt ſerved them for a head-band, the ſecond for a girdle, and that the third they conſtantly carried with them in the hand.

SLIPPING, among gardeners, the pulling off a ſprig from a branch, or a branch from an arm of the tree. And ſo a ſlip may have its rinds double and treble ſlipped, or its ſtalks ragged.

SLITTING MILL. See the article SMITHERY.

SLOATH, or SLOTH, in natural hiſtory, an animal remarkable for its ſlow motion.

The face of this creature is covered with hair; the claws are of a ſubulated form; there are no ears, nor are there any middle teeth. This is a very extraordinary animal, both in figure and qualities. It is hard to ſay to what other it is equal in ſize, ſince it is like none in ſhape; the length of the body is about a foot, and when well fed its thickneſs is equal to its length; the feet are flatted or plain, in the manner of thoſe of the bear or monkey, but are extremely narrow; the claws are very long and ſharp; the head is ſmall and round; and the face ſomething reſembling that of the monkey; the colour of the whole animal is a pale greyiſh brown. This creature is ſo very tedious in all its motions, that it will be three or four days in climbing up and coming down a tree, and does not go the length of fifty paces upon even ground in a day.

SLOUGH, a deep muddy place. The caſt ſkin of a ſnake, the damp of a coal-pit, and the ſcar of a wound, are alſo called by the ſame appellation. The ſlough of a wild boar is the bed, or mire, wherein he wallows, or in which he lies in the day time.

SLOUTH, or SLOUGHT, in hunting, is uſed for a company of ſome ſorts of wild beaſts, as a ſlouth of bears.

SLOW-WORM, in zoology, the Engliſh name of the cæcilia, called alſo the blind-worm, and by ſome the deaf adder: it is very venomous, and its bite often fatal.

SLUDS, a term uſed by the miners in Cornwall for half-roaſted ores.

SLUICE, in hydraulics, a frame of timber, ſtone, earth, &c. ſerving to retain and raiſe the water of the ſea, a river, &c. and on occaſion to let it paſs: ſuch is the ſluice of a mill, which ſtops and collects the water of a rivulet, &c. in order to diſcharge it at length, in greater plenty, upon the mill-wheel: ſuch alſo are thoſe uſed in drains, to diſcharge water off lands; and ſuch are the ſluices of Flanders, &c. which ſerve to prevent the waters of the ſea overflowing the lower lands, except when there is occaſion to drown them.

Sometimes there is a canal between two gates or ſluices, in artificial navigation, to ſave the water, and render the paſſage of boats equally eaſy and ſafe, upwards and downwards; as in the ſluices of Briare in France, which are a kind of maſſive walls, built parallel to each other at the diſtance of twenty or twenty-four feet, cloſed with ſtrong gates at each end, between which is a kind of canal or chamber, conſiderably longer than broad, wherein a veſſel being incloſed, the water is let out at the firſt gate, by which the veſſel is raiſed fif-

teen

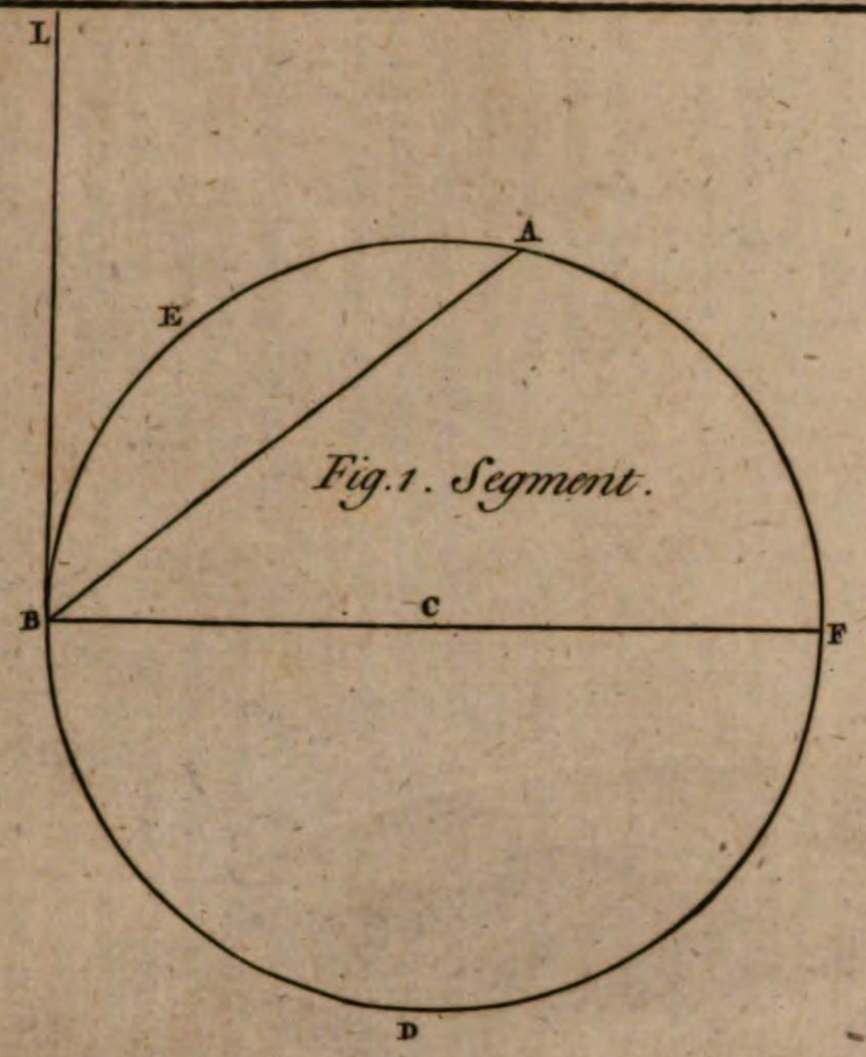


Fig. 1. Segment.

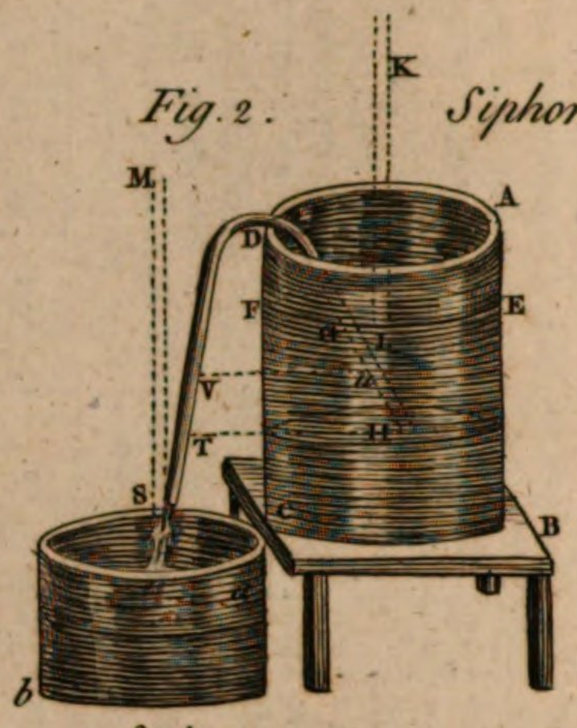


Fig. 2. Siphons

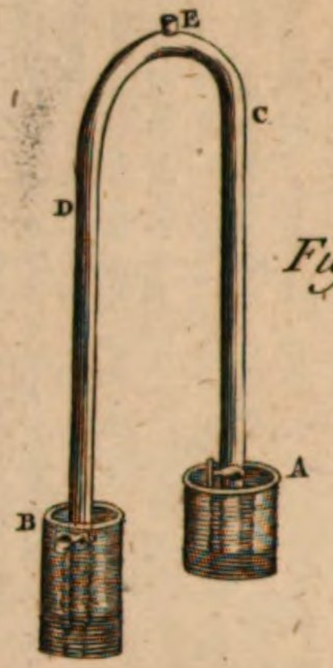


Fig. 3.

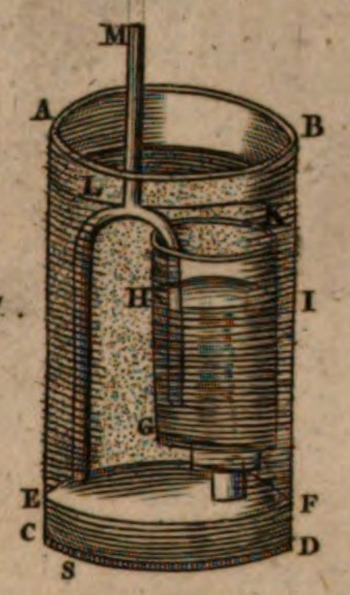


Fig. 4.

Siphons.

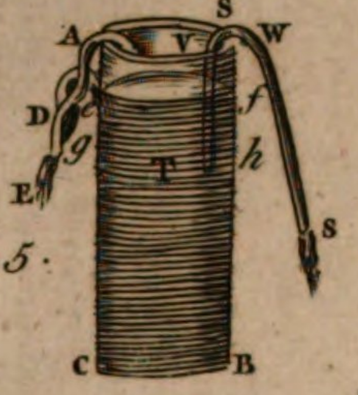


Fig. 5.

The upper Plan of a Sluice.

Fig. 6.

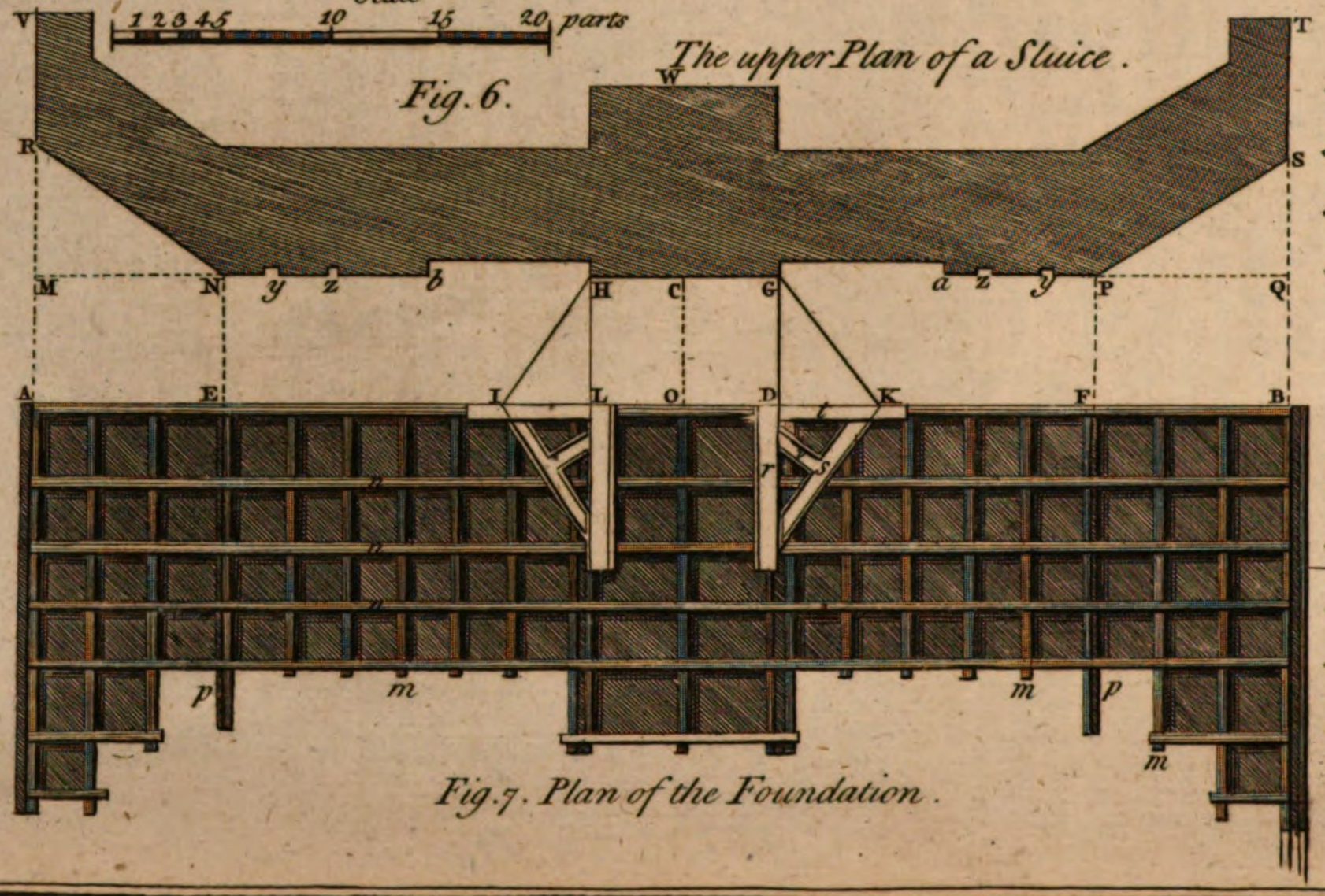


Fig. 7. Plan of the Foundation.

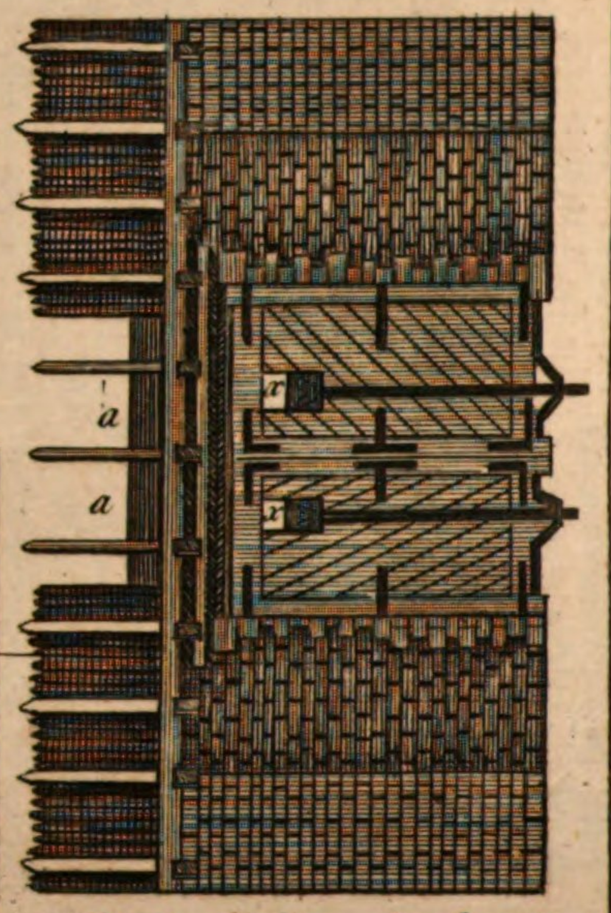


Fig. 8. Section Crofs wise

teen or ſixteen feet, and paſſed out of this canal into another much higher.

By ſuch means a boat is conveyed out of the Loire into the Seine, though the ground between them riſe above one hundred and fifty feet higher than either of thoſe rivers.

Conſtruction of SLUICES. The conſtruction of ſluices ought to be conducted by an able engineer, who is well acquainted with the action of fluids in general; and particularly with the ſituation of the place, the nature of the ſoil, &c. where the ſluice is to be erected: if on the ſea-ſhore, he ought to be perfectly well acquainted with the effects of the ſea, on that coaſt, and the ſeaſons when it is calm or ſtormy, that he may be able to prevent the fatal accidents thence ariſing: and, if in a river, it is neceſſary to know whether it uſually overflows its banks, and at what ſeaſons of the year its waters are higheſt and loweſt. The machines for driving the piles ſhould be placed about forty yards from the ſide of the ſluice, above and below it. As to the depth of the ſluices, it muſt be regulated by the uſes for which they are deſigned: thus, if a ſluice is to be erected at the entrance of a baſon for ſhipping, its depth muſt correſpond with the draught of water of the largeſt ſhip that may, at any time, have occaſion to enter thereby. The rule uſually obſerved, is to make the ſurface of the bottom of the canal on a level with the low-water-mark: but if the bottom of the harbour and canal be ſuch, as to be capable of becoming deeper by the action of the water, Belidor very juſtly obſerves, that the bottom of the ſluice-work ſhould be made deeper than either.

When a ſluice is to be placed at the bottom of an harbour, in order to waſh away the filth that may gather in it, by means of the waters of a river or canal; in this caſe the bottom of the ſluice-work ſhould be two feet or eighteen inches higher than the bottom of the harbour, that the water may run with the greater violence.

An engineer ought always to have in his view, that the faults committed in the conſtruction of ſluices are almoſt always irreparable. We ſhall therefore lay down ſome rules, from Belidor, for avoiding any overſights of this kind: 1. In order to adjuſt the level of the ſluice-work with the utmoſt exactneſs, the engineer ought to determine how much deeper it muſt be than a fixed point: and this he ſhould mark down in his draught, in the moſt preciſe terms poſſible. 2. When the proper depth is ſettled, the foundation is next to be examined; and here the engineer cannot be too cautious, leſt the apparent goodneſs of the ſoil deceive him: if the foundation is judged bad, or inſufficient to bear the ſuperſtructure, it muſt be ſecured by driving piles, or a great work of carpentry. 3. There ſhould be engines enough provided for draining the water; and theſe ſhould be entirely under the direction of the engineer, who is take care that they be ſo placed as not to be an obſtacle to the work; and alſo cauſe proper trenches to be cut, to convey the water clear off from the foundation. 4. When the ſluice is to be built in a place where the workmen will be unavoidably incommoded by the waters of the ſea, &c. all the ſtones for the maſon-work, as well as the timbers for that of carpentry, ſhould be prepared beforehand; ſo that when a proper ſeaſon offers for beginning the work, there remains nothing to be done, but to fix every thing in its place. 5. In order to ſhew the ſtate of the work, an exact journal ſhould be kept of the materials employed, to be ſigned every week by the chief engineer and undertaker; obſerving to diſtinguiſh the different pieces of materials, and the places where they were employed. 6. When an undertaker is found, who is not only able to be at the expence of providing all the materials, but likewiſe vigilant and active to execute whatever is judged neceſſary for the perfection of the work, it would be the worſt of policy to give the preference to others, who through ignorance, or diſhoneſty, bring in eſtimates lower than it is poſſible to execute the work as it ought. However, that the conditions of the contract may be properly executed, the chief engineer, or other perſons of unqueſtionable underſtanding and honeſty, commiſſioned for that purpoſe, ſhould take care that able workmen be employed, and that they execute their ſeveral parts in a proper manner.

Sluices are made different ways, according to the uſes they are intended for: when they ſerve for navigation, they are ſhut with two gates, preſenting an angle towards the ſtream; but when made near the ſea, there are two pair of gates, one to keep the water out, and the other to keep it in, as occaſion requires: the pair of gates next the ſea preſent an angle that way, and the other pair the contrary way; the ſpace incloſed by theſe gates is called a chamber.

When ſluices are deſigned to detain the water in ſome parts of the ditch of a fortreſs, they are made with ſhutters to ſlide up and down in grooves; and when they are made to cauſe an inundation, they are then ſhut by means of ſquare timbers let down into culliſes, ſo as to lie cloſe and firm.

Particular care muſt be taken, in the building of a ſluice, to lay the foundation in the ſecureſt manner poſſible; to lay the timber grates and floors in ſuch a manner, that the water cannot penetrate through any part, otherwiſe it will undermine the work; and, laſtly, to make the grates of a proper ſtrength, in order to ſupport the preſſure of the water; and yet to uſe no more timber than is neceſſary.

As a general conſtruction is much preferable to a particular one, we ſhall here give the deſcription of a large ſluice, with two pair of gates, from Mr. Muller's Fortification; which may be adapted to any particular caſe, provided a proper allowance be made for the various circumſtances in regard to their uſe and ſituation, as already obſerved.

To conſtruct then the plan of a ſluice, ſuppoſe half its width, OC, (plate CXIX. *fig.* 6.) to be divided into ſix equal parts, or the whole breadth into twelve: theſe parts ſerve for a ſcale whereby the dimenſions of the ſeveral parts of the work are determined. Through the point O, draw the line AB at right angles to OC, and take OB = 30 of the above parts; or, which is the ſame, equal 2 $\frac{1}{4}$ the width; through the points A and B, draw the lines AR, BS, at right angles to AB; and let the lines paſſing thro' the point C, and parallel to AB, meet thoſe laſt lines in M and Q: then, if MN and PQ be taken each equal to nine parts, and each of the lines MR and QS equal to ſix, the lines NR and PS will determine the wings of the ſluice and NP the body: and if the lines AR, BS, be produced, ſo that the parts RV and ST be each ſix parts, they will determine the faces.

The part of the length, OB, exceeds the other part OA, by $\frac{1}{4}$ of the width; becauſe we ſuppoſe a turning bridge is to be placed on that ſide, for a communication from one ſide of the ſluice to the other; but when there is no occaſion for ſuch a bridge, OB is made equal to OA; and then the whole length will be but four times and a half the width, which is, Mr. Belidor thinks, the beſt length for a great ſluice.

Next to determine the chamber, and the poſition of the gates, take OD and OL, each equal to four parts; and draw the lines DG and HL parallel to OC: then if the lines GK and HI be drawn, ſo as to make the angles DGK and LHI each = 35° 16′, it will be the beſt poſition that can be given. The cavities *z*, *y*, are a foot each way in large ſluices, and but nine inches in middling ones: they ſerve for letting down ſquare timbers to form a batardeau on each ſide, in caſe the gates or floor want to be repaired.

The receſſes G*a*, H*b*, in the wall, are made to receive the gates when open; and are of ſuch a depth, that they may be fluſh with the wall, and not make that part narrower than the reſt of the ſluice. The thickneſs of the wall from N to P is equal to $\frac{4}{5}$ of the depth of water; the parts RN and PS are $\frac{3}{5}$, and at V and T $\frac{2}{5}$. The counter-fort W is determined by producing the lines LH and DG, and projects beyond the wall by $\frac{1}{4}$ of the width of the ſluice.

As to the timber-grates under the floor and foundation (*fig.* 7.) if the foundation be bad, we ſuppoſe piles to be driven under the croſſings of the ſleepers *m* and the tie-beams *n*; and to prevent the water from getting under the foundation, ſix rows of dove-tail piles are driven, viz. one at each end, one at each of the angles N and P, (*fig.* 6.) marked *p* (*fig.* 7.) and one on each ſide of the chamber; and it muſt be obſerved, that, excepting

ing thoſe at the angles N and P, the reſt are all driven between two ſleepers, in order to keep them tight and cloſe together. The ſleepers and tie-beams are partly let into each other, and bolted together. And as to the maſonry between the gratings, bricks are preferred to ſmall ſtones; as being much cloſer, and filling up every part more exactly: they are laid in terras-mortar, as well as the reſt of the foundation; and the whole is covered with a floor of three-inch thick oaken planks, laid lengthwiſe. This done, the frames made to ſupport the gates at the bottom, are laid in their proper places; which are compoſed of a cell *r*, two hurters *s*, two braces *v*, and a tong *t*. The cell enters about three feet into the ſide walls, and the ſockets to receive the pivots of the gates are placed in it; the tong ought to be ſo long, as to croſs three ſleepers, to which it is ſtrongly faſtened; and the cell, tong, and hurters, ought to have the ſame dimenſions, and their height muſt be ſuch as to be a foot above the laſt floor of the ſluice and chamber; for which reaſon, the piles under the chamber are left a foot higher than the reſt.

Over the firſt floor is placed another, compoſed of ſleepers and tie-beams, &c. anſwering exactly to thoſe underneath, and covered with ſtrong oaken planks, laid lengthwiſe and nailed to the ſleepers, as in the firſt floor. But upon the ſecond floor is laid another of only two inch thick planks, which do not enter the wall, that they may be repaired when needful: this laſt floor may be made of yellow deal, and its ſeams muſt be well caulked, to prevent the water from making its way thro' them.

The walls muſt be made about three feet higher than the greateſt depth of the water; and the faces are formed of the largeſt ſtretchers and heads that can be had, laid in terras-mortar, and cramped together: but the reſt of the work may be done with good common mortar. The top of the wall muſt be covered with large flat ſtones or bricks laid in terras-mortar, to prevent the water from penetrating into the maſonry: and when all is finiſhed, a bed of clay ſhould be rammed againſt the wall, two feet thick, all round the outſide; beginning as low as the foundation, and raiſed as high as the wall.

To prevent the water from carrying off the earth, by its fall at the ends of the ſluice, a falſe floor of faſcines is made of as many fathoms long as the water in the ſluice is feet high: this falſe floor is faſtened with pickets upon an artificial bed of clay, nearly level with the floor of the ſluice; and above the faſcines is laid a pavement of hard ſtones well ſecured, ſo that the current may not tear them up. And for the greater ſecurity, a row of dove-tail piles is driven at each end: and it ought to be obſerved, that both floors, viz. that of the ſluices, and that above the faſcines, muſt have a gradual deſcent of about $\frac{1}{48}$ part of the length.

The croſs ſection (*fig.* 8.) ſhews the poſition of a row of piles, and the ſleepers above them, into which they are tenoned; alſo the heads of the tie-beams, the floor between them, the cell and the two floors above it: there is alſo ſeen a row of dove-tail piles, broken off in the middle, in order to ſee part of the maſonry *a a*, between the piles, and under the ſleepers. The out-ſides of the gates are alſo ſeen in this ſection; alſo how the planks are joined in the frame, the ſhutters, *x*, *x*, and the irons both of the gate and ſhutters.

In the conſtruction of gates, particular care ſhould be taken to join the ſeveral pieces together, in ſuch a manner, that the whole frame may be as ſtrong as poſſible, and yet not to make them more heavy than neceſſary. The principal parts of the frame of a gate are two ſtiles or uprights; that which is next to the wall, and to which the pivots are fixed, being called the pivot poſt, and the other the chamfered ſtile, from being edged off ſo as to make a plain joint with the other gate. The other pieces, which cannot be ſeen in this ſection, conſiſt of ſeveral rails, placed not nearer to each other than twenty-four inches, not farther than thirty; and of ſeveral braces, which form the ſame angle with the pivot-poſt, as the joints of the planks on the outſide.

As it would be too tedious to calculate the proper ſtrength of each piece, we ſhall give their dimenſions from Mr. Belidor, which, he ſays, were taken from thoſe moſt approved in practice. Suppoſing then the pieces of the principal frame to be the ſame, in the ſame ſluice, they will be as follows, in different ſluices. In thoſe from 8 to 12 feet wide, the principal pieces ſhould be 8 inches thick, and 10 broad; the intermediate rails, 6 by 8; the braces and monions, or ſhort uprights to form the wickets, 4 by 6; and the whole covered by two-inch thick planks, as well as all the gates of ſluices under 37 feet wide. In ſluices from 13 to 18 feet wide, the principal pieces ſhould be 10 by 12 inches; the intermediate rails, 8 by 10; and the braces and monions, 4 by 6. In ſluices from 19 to 24 feet wide, the principal pieces ſhould be 12 by 14 inches; the intermediate rails, 12 by 12; and the braces and monions, 5 by 7. In ſluices from 25 to 30 feet wide, the principal pieces ſhould be 14 by 16; the intermediate rails, 12 by 13; and the braces and monions 6 by 8. In ſluices from 31 to 36 feet wide, the principal pieces ſhould be 15 by 17; the intermediate rails, 13 by 14; and the braces and monions, 7 by 9. In all ſluices from 37 to 42 feet wide, the principal pieces ſhould be 16 by 18; the rails 14 by 16; and the braces and monions, 7 by 9. Laſtly, in all ſluices from 42 to 48 feet wide, the principal pieces ſhould be 18 by 20; the rails, 15 by 18; and the braces and monions, 8 by 10. However, it ought to be obſerved, that when the gates are very high, the middle rail is made of the ſame dimenſions with the principal pieces: alſo in ſluices above 36 feet wide, the planks of the gates muſt be 2 $\frac{1}{2}$ inches thick; or it may anſwer ſtill better, to lay two rows of plank of that thickneſs, in order that the ſeams of the under row may be covered by the planks of the upper one.

SMALLAGE, in botany, a ſpecies of apium.

Smallage has the leaves of the ſtalks wedge-like, and is called by authors apium paluſtre, peludapium, and eleoſelinum. It is aperient and diſcuſſive, and its root is one of the five great openers. It is very good in groſs conſtitutions, and infarctions of the lungs, eſpecially if eat with oil and muſtard. There needs no trouble to reduce it into any medicinal form, ſince it may be eaten ſo conveniently and agreeably in ſallads.

SMALT, a kind of mineral matter prepared from cobalt, ſometimes in form of a blue powder, and ſometimes in cakes. The preparation of zaffre and ſmalt is as follows.

The cobalt taken out of the mine is broken with hammers, into pieces about the ſize of a hen's egg; and the ſtony involucrum, with ſuch other heterogeneous matters as are diſtinguiſhable by the eye, as much as poſſible ſeparated. In this ſtate it is aſſayed, valued, taxed, tithed, and delivered to the manufactures. In digging the mines the workmen frequently meet with hard ſandy maſſes cutting and interrupting the vein. Theſe are broken in mills; and the cobalt, that had been imbedded in them, ſeparated by ſieves.

The mineral, brought to the manufactures, is pounded in ſtamping-mills, and ſifted through braſs wire ſieves: according to ſome, the lighter earthy parts are waſhed off by water. It is then calcined, in a large flat-bottomed, arched furnace, reſembling a baking oven, in which the flame of the wood reverberates upon the ore. The mineral is occaſionally ſtirred or turned during the calcination, with long handled iron hooks or rakes; and the proceſs continued till it ceaſes to emit any ſume: an hundred pounds are ſaid to loſe twenty or thirty.

Some relate, that the calcination is repeated ſeveral times, the ore being taken out and ground into powder each time; others, that it is calcined but once, and the calcination continued from four to nine hours, according to the quality of the cobalt. Some of the aſſayers lay great ſtreſs on the degree of calcination; and report that on this circumſtance, not only the beauty of the colour, but the quantity of coloured glaſs obtainable, in great meaſure depend; and that the degree of calcination which ſome cobalts require, would be injurious to others. Some, however, ſeem to be of opinion, that cobalts may be aſſayed with ſufficient accuracy, both in regard to colour and quantity, without any calcination at all, by barely melting the ore with borax. The cobalt taken out of the calcining furnace is paſſed through very cloſe braſs wire ſieves; and ſuch part as has con-

creted

creted into lumps, pounded and ſifted afreſh, till the whole is reduced into fine powder.

During the preparation of the cobalt, ſome flints are calcined in another furnace, and thrown red-hot into water; by which they are rendered friable and eaſily pulverable. The pureſt and whiteſt ſtones are made choice of; or ſuch at leaſt as become white by calcination. In want of theſe, white ſand is uſed.

Zaffre is compoſed of one part of the calcined cobalt, and one or two of the calcined flint, mixed together by ſhaking in a wooden box and ſifting, and then moiſtened with water. Macquer and ſome others report, that a certain quantity of pot-aſh is added to the above mixture, and the whole imperfectly melted. This account has little probability; as the ſtony powder is very diſtinguiſhable in zaffre, without any appearance of its having been united with the cobalt by fuſion; and as the maſſes have the ſhape of the wooden tubs in which they are brought to us, and conſequently cannot owe their hardneſs to fire.

For making the blue glaſs, called in the maſs ſmalt, and when powdered ſmalts or powder blue; one part of the calcined ore is mixed with one, two, or more of the flint, and one or more of pot-aſh; and the mixture melted in large crucibles, in a furnace much reſembling that of the glaſs-houſe. In each furnace are generally ſix crucibles, placed about the middle of its height.

The furnace has two doors, one in the front, the other behind: through the latter common billets are put in; through the former, ſplit wood, dried almoſt to charcoal in an adjoining oven heated by the furnace. In the front door is an aperture, for introducing ſmall aſſays, which is occaſionally cloſed with a piece of loam. In each ſide are three apertures for conveying the matter into the crucibles, and, after fuſion, taking it out with iron ladles: above theſe are three others, which are opened occaſionally for introducing the tongs to move or ſettle the crucibles: at the bottom are two more apertures, for taking out the aſhes and ſuch part of the glaſs as may have run out and fallen down among them; this is melted over again.

After the fire has been continued for ſix hours, the matter is ſtirred every quarter of an hour, with iron rods, to make the mixture the more equal: the fire is kept up in all, for the beſt ſmalt twelve hours, for the inferior kinds eight or ten. The mark of ſufficient vitrification is, the glaſs which adheres to the iron ſtirrer drawing out into a fine thread. The whole is now taken out with ladles, and poured into a tub of cold water, to render it more eaſily pulverable.

At the bottom of the crucibles is found a metalline regulus, of a whitiſh colour, inclining to red, and extremely brittle. When the crucibles have become unfit for any further fuſions of the glaſs, theſe reguli are melted in them, and are thus reſolved into two diſtinct metallic bodies, one which falls to the bottom, and another which floats above. The firſt is ſaid to be biſmuth: the latter is a ſemi-metal of a different kind, which yields a blue glaſs, and accordingly is pulverized and added in freſh mixtures.

The glaſs appears in the maſs of an opake deep blue, almoſt black; when reduced into moderately fine powder, of a pleaſant light blue: the further it is comminuted, the paler. It is firſt beat in a ſtamping-mill, and paſſed through a braſs-wire ſieve, an iron one being apt to ruſt and ſpoil the colour: after which, it is ground with water, on a ſmooth hard ſtone placed at the bottom of a large vat or tub, by two other hard ſtones turning vertically: the water, loaded with the fine powder, is let off by cocks into other veſſels, and ſuffered to ſettle: after the coloured powder has ſubſided, a white one remains ſuſpended in the water, which is now poured off, that the white matter may ſettle by itſelf: this is employed in freſh mixtures, in the room of flint and pot-aſh. The coloured powder is waſhed again, dried in a ſtove, paſſed through fine ſieves, and divided into different ſortments according to the fineneſs of the powder, and the beauty of the colour. In the laſt place, it is moiſtened with a little water, and packed up in caſks for exportation.

The richneſs of cobalt is judged from the quantity of flint and pot-aſh with which it will form a ſufficiently deep powder blue. The manufactures are provided with aſſayers, for determining the quantities which different parcels of the ore will bear. The produce of ſmalt appears to be never leſs than equal, nor more than four times the weight of the crude ore.

SMARAGDUS, the emerald, in natural hiſtory. See EMERALD.

SMECTIS, a name by which ſome call fuller's earth. See FULLER'S-EARTH.

SMELL, *Odor*, with regard to the organ, is an impreſſion made on the noſe, by little particles continually exhaling from odorous bodies: with regard to the object, it is the figure and diſpoſition of odorous effluvia, which, ſticking on the organ, excite the ſenſe of ſmelling: and with regard to the ſoul, it is the perception of the impreſſion of the object on the organ, or the affection in the ſoul reſulting therefrom.

The principal organs of ſmelling are the noſtrils, and the olfactory nerves; the minute ramifications of which latter are deſcribed throughout the whole concave of the former.

According to Boerhaave, the act of ſmelling is performed by means of odorous effluvia floating in the air, being drawn into the noſtrils, in inſpiration, and ſtruck with ſuch force againſt the fibrillæ of the olfactory nerves, which the figure of the noſe, and the ſituation of the little bones, render oppoſite thereto, as to ſhake them, and give them a vibratory motion; which action, being communicated thence to the common ſenſory, occaſions an idea of a ſweet, or fœtid, or ſour, or an aromatic, or a putrified object, &c. The matter in animals, vegetables, foſſils, &c. which chiefly affects the ſenſe of ſmelling, Boerhaave obſerves, is that ſubtile ſubſtance inherent in the oily parts thereof, called ſpirit; for that, when this is taken away from the moſt fragrant bodies, what remains has ſcarce any ſmell at all; but this, poured on the moſt inodorous bodies, gives them a fragrancy.

Willis obſerves, that brutes have, generally, the ſenſe of ſmelling in much greater perfection than man; and by this alone, they diſtinguiſh virtues and qualities of bodies unknown before; hunt out their food at a great diſtance, as hounds, and birds of prey; or hid among other matters, as ducks, &c. Man having other means of judging of his food, &c. did not need ſo much ſagacity in his noſe; yet have we inſtances of a great deal, even in man. In the Hiſtoire des Antilles, we are aſſured, there are negroes who, by the ſmelling alone, can diſtinguiſh between the footſteps of a Frenchman and a negroe.

The chemiſts teach, that ſulphur is the principle of all ſmells, and that thoſe are more or leſs ſtrong, as the ſulphur in the odorous body is more or leſs dried or exalted. Sulphur, they ſay, is the foundation of odours, as ſalt is of ſavours, and mercury of colours.

Smell, like taſte, conſiſts altogether in the arrangement, compoſition, and figure of the parts, as appears from the following experiments of Mr. Boyle. 1. From a mixture of two bodies, each of which is of itſelf void of ſmell, a very urinous ſmell may be drawn, that is, by grinding of quick-lime with ſal ammoniac. 2. By the admixture of common water, which, of itſelf, is void of all ſmell, or inodorous, another inodorous body may be made to emit a very rank ſmell. Thus camphire diſſolved in oil of vitriol, is inodorous, yet, mixed with water, immediately exhales a very ſtrong ſmell. 3. Compound bodies may emit ſmells which have no ſimilitude to the ſmell of the ſimples they conſiſt of. Thus oil of turpentine, mixed with a double quantity of oil of vitriol, and diſtilled; after diſtillation, there is no ſmell but of ſulphur, and what is left behind, the retort being again urged by a more violent fire, yields a ſmell like oil of wax. 4. Several ſmells are only to be drawn forth by motion and agitation. Thus glaſs, ſtones, &c. which even when heated yield no ſmell, yet, when rubbed and agitated in a peculiar manner, emit a ſtong ſmell; particularly beech-wood, in turning, yields a kind of roſy ſmell. 5. A body that has a ſtrong ſmell, by being mixed

with an inodorous one, may ceaſe to have any ſmell at all. Thus, if aqua fortis, not well dephlegmated, be poured on ſalt of tartar, till it ceaſes to ferment, the liquor when evaporated will yield inodorous cryſtals, much reſembling ſalt of nitre; yet when burnt, will yield a moſt noiſome ſmell. 6. From a mixture of two bodies, one whereof ſmells extremely ill, and the other not well, a very pleaſant aromatic odour may be gained, viz. by a mixture of aqua fortis, or ſpirit of nitre, with an inflammable ſpirit of wine. 7. Spirits of wine, by mixing with an almoſt inodorous body, may gain a very pleaſant aromatic ſmell. Thus inflammable ſpirits of wine, and oil of Dantzic vitriol, mixed in equal portions, then digeſted, and at laſt diſtilled, yield a ſpirit of a very fragrant ſmell. 8. A moſt fragrant body may degenerate into a fœtid one, without the admixture of any other body. Thus, if the ſpirit mentioned in the former experiment be kept in a well cloſed receiver, it will ſoon turn to the rankneſs of garlic. 9. From two bodies, one whereof is inodorous and the other fœtid, a very pleaſant ſmell may ariſe, much reſembling muſk, &c. by putting pearls into ſpirit of vitriol; for, when diſſolved, they yield a very agreeable ſmell.

SMELL is uſed as the name of a particular ſort of wine, of which there are two ſpecies: the one ſort is very fragrant, muſcatelline, and aromatic; this is called ſimply the ſmell-wine; but the other, which is very rank and offenſive to the noſe, is called by the Germans ſmelbruntzer. Many have been the conjectures about the occaſion of the rank ſmell of this wine, it not being owing to the grape it is made from, thoſe of the ſame vineyard often affording the aromatic, and often the rank wine: ſome have imputed the ſtrange difference to the veſſel, others to the vine, and others to the earth it grows in; but the firſt of theſe is too trifling a cauſe for ſuch an effect, and the others are confuted by experience of the ſame vine, in the ſame place, yielding both. The opinion of Portzius is, that the rankneſs of the ſmell of ſome of this wine is owing to ſome irregularities in the working. This is certain, that it never is perceived before the working. The ſmell is truly urinous, and is that of a volatile alkali; which not being embodied in, or ſubdued by the acid of the grape, in this imperfect fermentation, ſhews itſelf in this rank manner. It is evident that the ſmell is of a volatile nature, for it is often loſt in the drawing the wine ſeveral times out of one veſſel into another, evaporating during the time of the drawing it out.

SMELT, in ichthyology, the oſmerus with ſeventeen rays in the pinna ani. This is a beautiful little fiſh; its length is five or ſix inches, and its breadth not great in proportion, but the thickneſs is conſiderable: the head is of an oblong figure, and ſomewhat acute; the opening of the mouth is large, the back is convex, and the belly ſomewhat flat; the lower jaw is a little longer than the upper; the noſtrils ſtand in the middle between the eyes and the extremity of the roſtrum; they have each two apertures; the eyes are large and round, the pupil is black, and the iris of a ſilvery white, but tinged a little with blue towards the upper part.

Theſe fiſh will live almoſt any where, but they are very apt to degenerate. They are common in the rivers of New-England, and are as large as with us, often weighing two ounces and a half; but, a pail-full of theſe being taken from one of their rivers, and put into an adjoining pond, they all degenerated in ſuch a manner, that they were afterwards found ſo ſmall, that the largeſt did not weigh more than five penny-weights. Though thus ſmall, however, they are much valued, and are better taſted than the others.

SMELTING, in metallurgy, the fuſion or melting of the ores of metals, in order to ſeparate the metalline part from the earthy, ſtony, and other parts.

SMELTING-HOUSE, a houſe wherein they run and ſmelt the ore into lead: one of theſe will run a ton in ten or twelve hours; a fodder is their uſual day's work, that is, twenty two hundred and an half weight.

SMITHERY, or SMITHING, a manual art, by which an irregular lump of iron is wrought into an intended ſhape.

In plate CXXI. *fig.* 1. repreſents the ſmith's forge and bellows; *fig.* 2. the anvil ſet in a wooden block, its face being A, and B its beak or beak-iron, corruptly called biekern; *fig.* 3, and 4. two kinds of tongs, where A, A are the chaps, B the joint, and C, C the handles; *fig.* 5. repreſents two kinds of hammers, of which A is the face, B the pen, C the eye, and D the handle; *fig.* 6. is the vice, of which A, A are the chaps, C the ſcrew-pin, D the nut, E the ſpring, and F the foot; G is a hand-vice; and H, H the pliers; *fig.* 7. is the ſcrew-plate and its tap; and *fig.* 8. a drill.

Theſe are the moſt eſſential tools uſed in the blackſmith's trade; however, as ſome kinds of work require different tools, we ſhall here deſcribe a machine for iron-work. A B *fig.* 9. is called the ſlitting mill, C D the plate mill, and S P the clipping-mill. E and F are two great water-wheels, ſo diſpoſed that when the water has paſſed the wheel E in the direction Q W, it comes about the wheel F in the direction X Y. The water-wheel E, with the lantern G on the ſame axis, carries the ſpur-wheels, or cog-wheels H, M, with the cylinders B and D: and the wheel F, with the lantern I, carries the cog-wheels K, N, with the cylinders A and C. Now the cylinders A and B, as alſo C and D, turn contrary ways about; the cylinders A and B are cut into teeth for ſlitting iron-bars, and are about twelve inches in diameter, whereas C and D are only eight inches in diameter. Theſe cylinders may be taken out and others put in at pleaſure; they may alſo be brought nearer to, or removed farther from, each other, by means of ſcrews which ſcrew up the ſockets where their axles turn. The axles of N, I, K, lie all in one horizontal plane; and ſo do thoſe of M, G, H: but the cylinders A and B, as alſo C and D, lie one above another.

In order to make iron-plates, if a bar of iron be heated and made thin at the end, and that end put in between the cylinders C and D, whilſt the mill is going, the motion of the cylinders will draw it through, on the other ſide, into a thin plate. Likewiſe, if a bar of iron be heated and thinned at the end, and put in between the toothed cylinders A and B, it will be drawn through on the other ſide, and ſlit into ſeveral ſmall pieces, or ſtrings; and then, if there be occaſion, any of theſe ſtrings may be drawn through the plate-mill with the ſame heat, and faſhioned into plates.

In the clipping-mill, O P Q is the ſheers for clipping bars of cold iron; V, a cog in the axis of the water-wheel; O P, one ſide of the ſheers made of ſteel, and moveable about P. The plane L P R is perpendicular to the horizon. When the mill goes, the cog V raiſes the ſide O P, which as it riſes, clips the bar T Q into two, by the edges S P and R P.

The whole of this engine, except the water-wheels, is within the houſe.

SMOKE or SMOAK, *fumus*, a humid matter, exhaled in form of vapour, by the action of heat, either internal or external.

Smoke, Sir Iſaac Newton obſerves, aſcends in the chimney by the impulſe of the air it floats in; for that air being ramified by the fire underneath, has its ſpecific gravity diminiſhed; thus, being determined to aſcend itſelf, it carries up the ſmoke along with it. The tail of a comet that great author takes to aſcend from the nucleus after the ſame manner.

SMOKE-JACK, a very ſimple and commodious machine, in a kitchen; ſo called from its being moved by means of the ſmoke, or rarified air, moving up the chimney, and ſtriking againſt the tail of the horizontal wheel, A B (plate CXIV. *fig* 8.) which being inclined to the horizon, is thereby moved about the axis of the wheel, together with the pinion C, which carries the wheel D and E; and E carries the chain F, which turns the ſpit.

The wheel A B ſhould be placed in the narrow part of the chimney, where the motion of the ſmoke is ſwifteſt, and the greateſt part of it muſt ſtrike upon the ſails. The force of this machine is ſo much greater, as the fire is greater.

SMUGGLERS, in law, thoſe perſons who conceal or run prohibited goods, or goods that have not paid his majeſty's cuſtoms.

SMUT, in huſbandry, a diſeaſe in corn, in which the grains, inſtead of being filled with flour, are full of a black ſtinking powder.

Many

Smithery

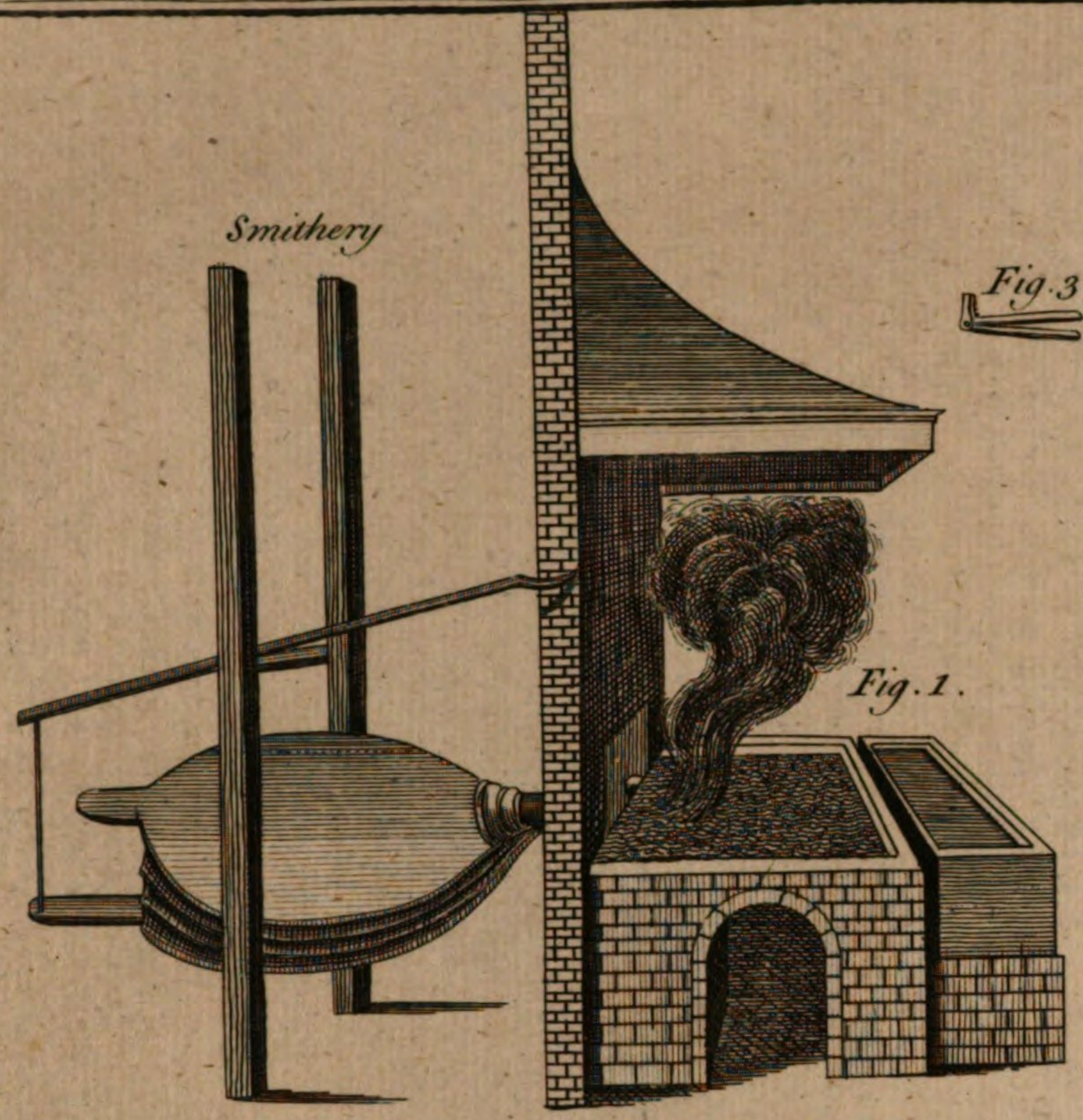


Fig. 1.

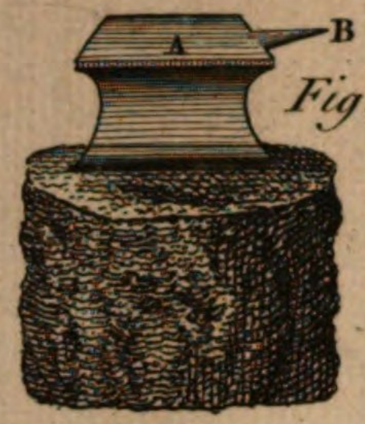
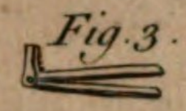


Fig. 2.



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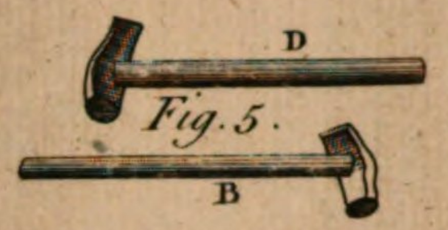

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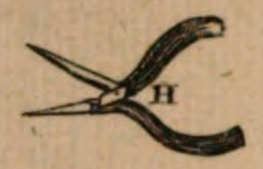

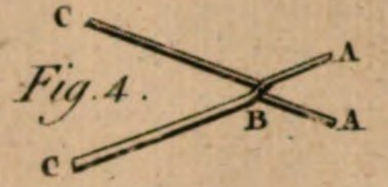

Fig. 4.

Fig. 7.

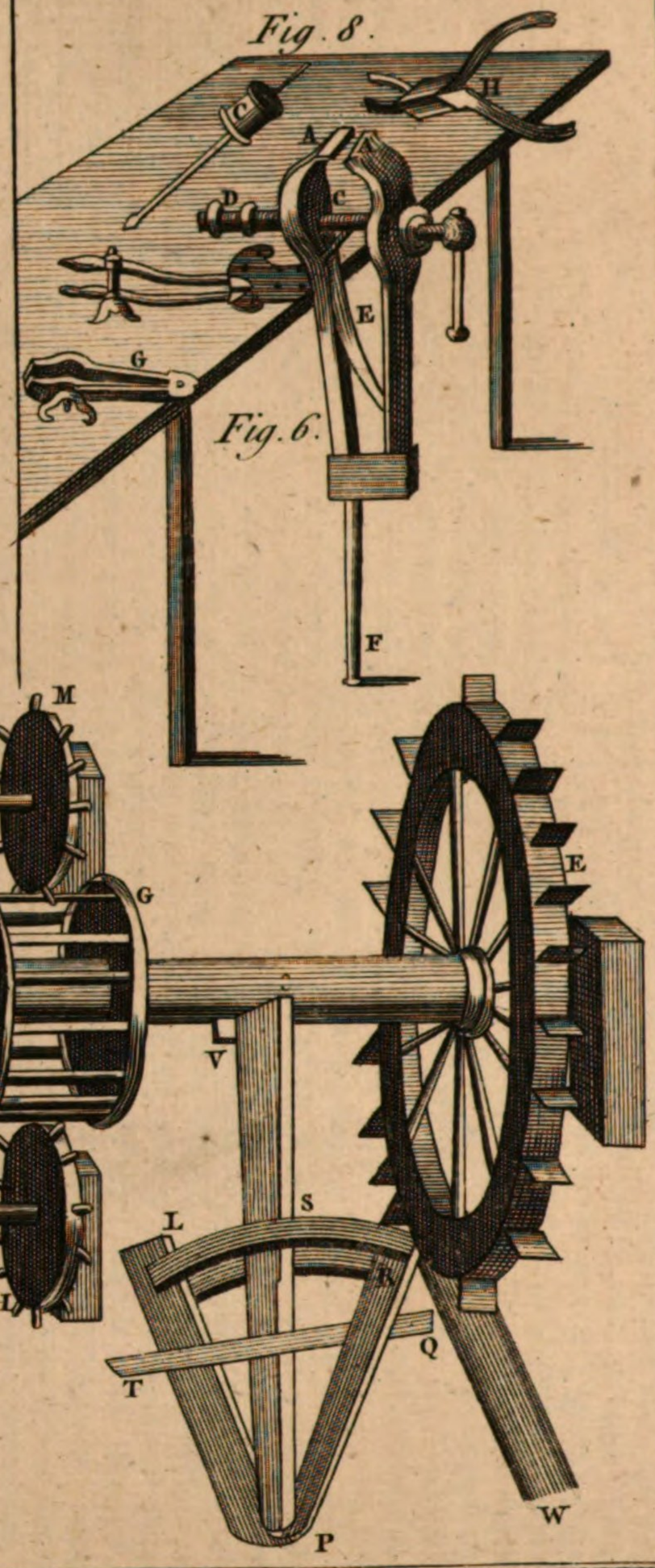

Fig. 8.

Fig. 6.

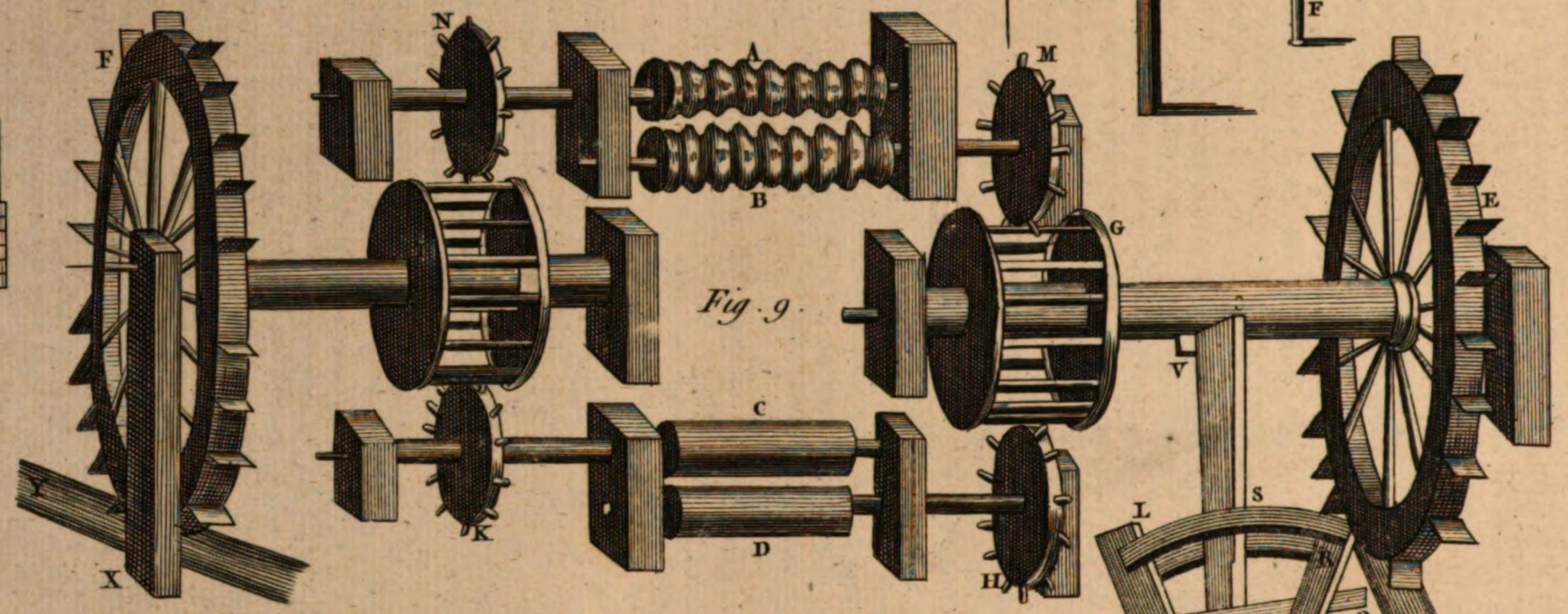

Fig. 9.

A Machine used in Smithery for making & Slitting Iron Plates

Solid of least resistance.

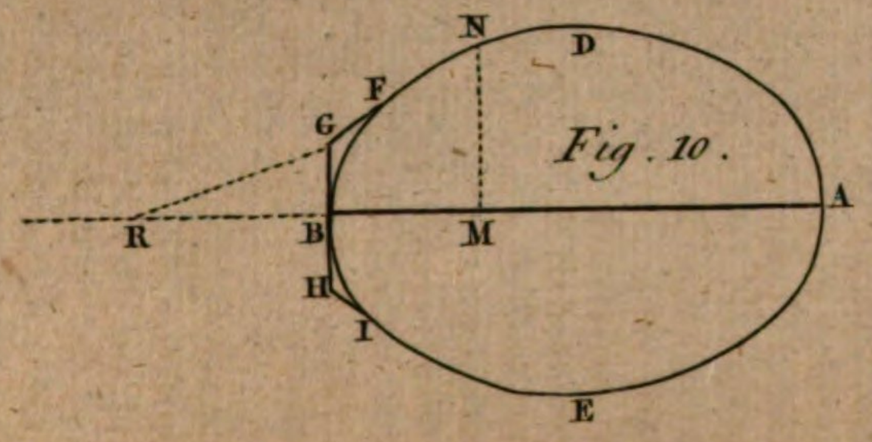

Fig. 10.

Many things have been ſuſpected as the cauſes of this diſtemperature in corn; but Mr. Tull ſeems convinced by experiment, that it is cauſed only by too much moiſture, the ſeveral plants of corn, which he had taken up by the roots and planted in troughs of very moiſt earth, all bringing forth ſmutty ears, while very few ſuch were found in the corn of the field from whence theſe plants were taken. It is obſervable, alſo, that thoſe ears, the grains of which are to be ſmutty, never ſend up any flowers at all.

The two things recommended by writers of huſbandry as remedies or preventions of this diſeaſe, are brining and changing the ſeed. The firſt of theſe methods was accidentally diſcovered about a century ago: A ſhip loaded with wheat was, about autumn, ſunk near Briſtol, afterwards the wheat was taken up at the ebbs at ſeveral times, after being thoroughly ſoaked in ſea water. When the wheat was all taken up, it was found unfit to make bread of; but a farmer, trying ſome of it for ſowing, found it anſwer very well, and himſelf and the neighbouring farmers bought it all up at a ſmall price; the country all about was ſown out of this cargo. It happened that ſmuttineſs in the wheat-corn was a reigning diſtemper in all parts of the kingdom at that time, but it was remarkable, that all the fields ſown with this ſalt wheat were abſolutely free from the miſchief: this eaſily introduced the practice of ſoaking wheat, before ſowing, in a brine of ſalt and water, to prevent it in other places, and it has ſucceeded well. Mr. Tull gives an inſtance of the certainty of its effect, in the caſe of two farmers whom he perſonally knew, and whoſe farms lay intermixed: theſe men bought the ſame ſeed between them from a very good change of land, and parted every land between them in the field; the oldeſt farmer believed the brining to be a fancy, and ſowed his ſeed unbrined; the other brined all his ſeed, and the conſequence was, that the old farmer had a great deal of ſmut in his corn, while the other had not one ſmutty ear.

When wheat is intended for drilling, it muſt be ſoaked in no other brine than that of pure ſalt and water; for, if there be any greaſe among it, it will never be dry enough for this manner of ſowing. If ſeed wheat be ſoaked in urine, it will not grow; and if it be only ſprinkled, it will moſt of it die, unleſs it be planted preſently. The moſt expeditious way of brining wheat for drilling, is to lay it in a heap, and waſh it with a ſtrong brine ſprinkled on it, ſtirring it up with a ſhovel, that it may be all equally brined or wetted with it: after this, ſift on ſome fine lime all over the ſurface, and ſtir it up, ſtill ſifting on more in the ſame manner, till the whole is duſted with the lime; it will then be ſoon dry enough to be drilled without farther trouble. It muſt be quicklime, in its full ſtrength, that is uſed on this occaſion.

Bad years will cauſe ſmut in corn, and good years will prevent it: it is, however, obſervable, that the crops in which there is ſmutty corn, will, if uſed for ſeed, be liable to produce ſmutty corn again, rather than other ſeed. The brining is a defence againſt bad years, and againſt the miſchiefs attending the ſowing corn among which there has been ſmut.

Seed-wheat ſhould be brought from the crop on a ſtrong clay land, whatever kind of land it is to be ſowed upon. A white clay is a good change for a red clay, and a red clay for a white; but whatever the land be, from which the ſeed is taken, it may be infected, if that be not changed there the preceding year; and then there may be danger, though it be had from ever ſo proper a land. It is a rule among the farmers, never to buy ſeed-wheat from a ſandy ſoil; they expreſs their diſlike of this by the coarſe rhime, "Sand is a change for no land."

A crop of wheat, very early planted, is not ſo apt to be ſmutty, as one planted leſs early; and the farmers have obſerved, that the largeſt and plumpeſt ground for wheat is more liable to be ſmutty than the ſmall ground wheat. *Tull's Horſe-hoeing Huſbandry.*

SNAFFLE, in the manege, is a very ſlender bit-mouth, without any branches, much uſed in England; the true bridles being reſerved for the ſervice of war.

The ſnaffle, or ſmall watering-bit, is commonly a ſcratch mouth, with two very little ſtraight branches, and a curb, mounted with a head-ſtall, and two long reins.

SNAIL, *Limax*, in natural hiſtory, a genus of the gymnarthria, or naked inſects, the body of which is of a figure approaching to cylindric, and is perforated at the ſide: the tentacula, or horns, as they are called, are four in number, and two of them have the appearance of eyes.

There a great many ſpecies of ſnails, whereof we ſhall only mention a few. 1. The black naked ſnail, a conſiderably large inſect, being commonly three inches long, and half an inch broad; its whole body is furrowed and much wrinkled, and is of a deep black, except the belly, which is grey.

2. The naked reddiſh ſnail grows only to about two inches in length, and is alſo covered with numerous ſlight furrows.

3. The amber-coloured ſnail, when full grown, is only about an inch and a half long: its colour is a gloſſy yellow, with a caſt of brown in it, and the whole body is variegated with ſpots of a greyiſh colour.

4. The oat ſnail, a name given by Dr. Liſter, in the Philoſophical Tranſactions, to a ſmall ſnail, which he obſerved under the looſe bark of old willows, elms, and other trees, and which is of a very ſingular ſtructure; the ſhell reſembling an oat corn, whence the name and its volutæ, or wreaths, running contrary to the direction of them in other ſnails, that is, eaſt and weſt, as the philoſophers expreſs it, referring it to the motion of the ſun; but theſe ſhells, to uſe that language, have the turns weſt and eaſt, or, more plainly, they have the turns running from the right hand to the left, not from the left to the right, as other ſnails. *Phil. Tranſ. Num.* 250.

Snails are great deſtroyers of fruit in our gardens, eſpecially of the bitter ſorts of wall-fruit. Lime and aſhes, ſprinkled on the ground where they moſt reſort, will drive them away, and deſtroy the young brood of them. It is a common practice to pull off the fruit they have bitten; but this never ſhould be done, for they will eat no other till they have wholly eat up this, if it be left for them.

The Romans were fond of ſnails, and had them fed on purpoſe for their tables. Their taſte is not delicious, but rather diſagreeable; but this they diſguiſed by means of good ſauces, and had other reaſons for the receiving them into the liſts of foods.

They uſed them as provocatives or inciters to venery, and with this intent they eat only the necks, as the part in which the parts of generation of the creature were placed; and they had the greater opinion of the efficacy of theſe, as the parts of generation were double in each individual, that is, the male and female parts both ſituated in the neck of every ſnail.

Ariſtotle, and the old Greeks, had no idea of the generation of theſe inſects in the manner of other animals, but ſuppoſed them produced ſpontaneouſly; but the Romans ſhew by many paſſages in their writings, that they had got over this error, and even ſeem, by the preference they give to the neck of this animal, in this intention, to have underſtood the hermaphrodite ſtructure of this inſect, which much later ages have pretended to make a new diſcovery.

The eaſtern nations at preſent entertain the ſame opinions of the old Romans, as to provocatives; they uſe, as the others did, every thing that ſerves to the purpoſes of generation in other animals, and every thing that has but the reſemblance of the external figure of the parts ſubſervient to it. The orchis roots, which reſemble the teſticles of animals in ſhape, and contain a white and ſlimy, or viſcous liquor, have introduced themſelves into uſe on this plan, and ſo of many other things.

SNAKE, *Anguis*, in natural hiſtory, the name of a well known reptile, of the ſerpent kind.

The common ſnake is a harmleſs and inoffenſive animal, and might even be kept tame in houſes, to deſtroy vermin.

Its fleſh is reſtorative, like that of the viper. See VIPER.

SNAKE *with two Heads*, a kind of ſnake in Braſil, having a ſwelling at his tail, which, at a diſtance, has the appearance of a head.

The Portugueſe call it ſnake with two heads; their fear of this creature, for the bite of which they pretend there is no remedy, having prevented their examining into the truth. They alſo pretend that it is dangerous to meddle with theſe ſnakes after they are dead, and that barely touching them will give the itch. Mr. Couplet was, notwithſtanding, bold enough to flay ſeveral of them, but found himſelf, after having performed this operation on two or three, all covered with puſtules filled with a reddiſh water. Theſe remained on him a conſiderable time, and he was not quite well in three months.

The country of Braſil abounds with large ſnakes, the bite of which is venomous, but the natives and blacks make no ſcruple of eating them.

SNAKE-ROOT. See the article SERPENTARIA.

SNAPDRAGON, in botany, a genus of plants, the flower of which conſiſts of one leaf of a tubular form, perſonated, and having two lips, the upper of which is bifid, and the lower trifid. The piſtil ariſes from the cup, and is fixed, in the manner of a nail, in the hinder part of the flower; and afterwards becomes a ſeed-veſſel, of the ſhape of the head of a hog, divided into two cells, and uſually filled with ſmall ſeeds fixed to a placenta.

Many of the ſpecies of this plant are very beautiful, and much eſteemed in gardens, and are all eaſily propagated from ſeeds, which muſt be ſown in a dry ſoil, not too rich, in April or May. In July the plants may be planted out into large borders, where they will flower the ſpring following; or they may be ſown early in the ſpring, and they will then flower in the next autumn; but then they are not ſo likely to ſtand the winter, and, if the autumn proves not kindly, they will hardly produce a perfect thin ſeed. They all grow very well on old walls, where they have happened to ſow themſelves.

SNEEZING, *Sternutatio*, a convulſive motion of the muſcles of the breaſt, uſed in exſpiration: wherein, after ſuſpending the inſpiration begun, the air is repelled from the mouth and noſe, with a momentary violence and noiſe.

The cauſe is an irritation of the upper membrane of the noſe, which communicates with the intercoſtal nerve by means of the twigs that it detaches to it.

This irritation is performed either externally, by ſtrong ſmells, as marjoram, roſes, &c. or by ſharp, pungent, medicines, as creſſes and other ſternutatories, which vellicate the membrane of the noſe; or internally, by the acrimony of the lympha or mucus, which naturally moiſtens that membrane.

SNOW, *Nix*, a meteor formed, in the middle region of the air, of vapours raiſed by the action of the ſun, or ſubterraneous fire; there congealed, its parts conſti pated, its ſpecific gravity increaſed, and thus returned to the earth in little white villi, or flakes.

The ſnow we receive, may properly enough be aſcribed to the coldneſs of the atmoſphere through which it falls. When the atmoſphere is warm enough to diſſolve the ſnow before it arrives at us, we call it rain; if it preſerve itſelf undiſſolved, it makes what we call ſnow.

Dr. Grew, in a diſcourſe of the nature of ſnow, obſerves, that many parts thereof are of a regular figure, for the moſt part ſo many little rowels or ſtars of ſix points, and are perfect and tranſparent ice, as any we ſee on a pond, &c. Upon each of theſe points are other collateral points, ſet at the ſame angles, as the main points themſelves; among which there are divers other irregular, which are chiefly broken points, and fragments of the regular ones. Others alſo, by various winds, ſeem to have been thawed and froze again into irregular cluſters; ſo that it ſeems as if the whole body of ſnow were an infinite maſs of icicles irregularly figured; that is, a cloud of vapours being gathered into drops, the ſaid drops forthwith deſcend; upon which deſcent, meeting with a freezing air, as they paſs through a colder region, each drop is immediately froze into an icicle, ſhooting itſelf forth into ſeveral points; but theſe ſtill continuing their deſcent, and meeting with ſome intermitting gales of warmer air, or in their continual waſtage to and fro, touching upon each other, ſome of them are a little thawed, blunted, and again froze into cluſters, or intangled ſo as to fall down in what we call flakes.

The lightneſs of ſnow, although it is firm ice, is owing to the exceſs of its ſurface, in compariſon to the matter contained under it; as gold itſelf may be extended in ſurface, till it will ride upon the leaſt breath of air.

The uſes of ſnow muſt be very great, if all be true Bartholin has ſaid in its behalf, in an expreſs treatiſe, *De Nivis Uſu Medico*; he there ſhews, that it fructifies the earth, which indeed, is a very old and general opinion, preſerves from the plague, cures fevers, cholics, tooth-achs, ſore-eyes, and pleuriſies, for which laſt uſe, his countrymen of Denmark uſe to keep ſnow-water gathered in March. He adds, that it contributes to the prolongation of life; giving inſtances of people in the Alpine mountains that live to great ages; and to the preſerving dead bodies, inſtances whereof he gives in perſons buried under the ſnow in paſſing the Alps, which are found uncorrupted in the ſummer, when the ſnow is melted.

He obſerves, that, in Norway, ſnow-water is not only their ſole drink in the winter, but ſnow even ſerves for food; people having been known to live ſeveral days, without any other ſuſtenance.

Indeed the generality of theſe medicinal effects of ſnow are not to be aſcribed to any ſpecific virtue in ſnow, but to other cauſes. It fructifies the ground, for inſtance, by guarding the corn or other vegetables from the intenſer cold of the air, eſpecially the cold piercing winds. And it preſerves dead bodies, by conſtipating and binding up the parts, and thus preventing all ſuch fermentations or internal conflicts of their particles, as would produce putrefaction.

Snow may be preſerved by ramming it down in a dry place, under-ground, and covering it with chaff, in the manner of ice.

SNUFF, a powder chiefly made of tobacco, the uſe of which is too well known to need any deſcription here. See TOBACCO.

SOAP, or SOPE, in commerce, and the manufactures, a kind of paſte, ſometimes hard and dry, and ſometimes ſoft and liquid, and much uſed in waſhing, whitening linens, and by dyers, fullers, &c. The principal ſopes of our manufacture are the ſoft, the hard, and the bole ſope; all which conſiſt of an intimate union of the ſalt of pot-aſh with oil, or animal fat.

The fine hard white ſopes are made with oil olive and an alcali acuated with quick-lime, which promotes the action of the ſalt upon the oil, and at the ſame time diſpoſes the ſope to a hard and dry conſiſtence, which it does not eaſily aſſume when made with plain alcali. I have tried to prepare ſope with alcaline ley alone, and with lime water alone: with the firſt, the ſope turned out ſoftiſh and unctuous: with the latter, I obtained, not a true ſope, but a hard brittle compound, from which the oil ſeparated on trying to diſſolve it in water. A quantity of common ſalt is generally added in the proceſs, but it does not enter the compoſition of the ſope: The uſe of this ſalt is, when the oil has been incorporated, by boiling, with the alcaline ſalt of the ley, to promote the ſeparation of the ſaponaceous concrete from the water: it is only at this period that the ſea-ſalt is added. The ſea-ſalt may be recovered from the remaining liquor by cryſtallization; if any part of it happens from unſkilful management, to be retained in the ſope, it ſeparates in little cryſtals as the ſope dries,

The greateſt quantities of ſope are made in Spain, Portugal, France, and Italy; oil-olive being in thoſe countries moſt plentiful. The moſt common and cheapeſt, of the foreign ſopes, is that of Venice. I have ſeen the preparation of this ſort: it is made from three parts of good oil-olive, and two of a cauſtic ley; which ley is drawn from two parts of Spaniſh ſoda and one of quick-lime, with a ſuitable quantity of water. No metalline veſſels are made uſe of: the boilers are compoſed of building ſtone, joined by a particular cement, and ſecured with iron cramps: in theſe the oil and ley, to the quantity of ſome hundred weights at a time, are kept gently ſimmering for ſeveral days and nights. The Venetians

netians prepare alſo a green ſope, from old oil, the mother ley of the white ſope, and other refuſe matters, adding a certain portion of the juice of beet-leaves, which communicates the green colour: the juice is preſſed out by a horſe-mill conſiſting of an horizontal ſtone, with a perpendicular one turning upon it, as in the gunpowder-mills. The common coarſe ſopes are made with tallow: and the ſoft, blackiſh, and greeniſh ſorts with train oil.

Fixed alcalies unite much more difficultly with eſſential oils than with the expreſſed. For making a ſope with oil of turpentine, formerly celebrated as a medicine under the names of Sope of Tartar, the Univerſal Corrector, &c. different proceſſes have been purſued, and all of them tedious or defective. Some mix the oil of turpentine with a well calcined ſalt of tartar, and ſtir them together every day for half a year or longer, till the union is completed: ſome dry the mixture occaſionally, as often as it is found to have imbibed moiſture from the air. Some have ſecured the mixture in a ſtrong glaſs fixed to the clapper of a mill or the ſail of a windmill, that by this means it might be kept in conſtant agitation: but ſimple agitation is not ſufficient. Some boil the oil with a cauſtic ley, keeping the whole continually ſtirring, nearly in the ſame manner as for making ſope with expreſſed oils. Others pulverize the ſalt, ſtrongly heated, in a mortar, and pour upon it whilſt very hot, the oil of turpentine likewiſe heated: by this method a ſope is moſt expeditiouſly obtained, but the more ſubtile parts of the oil are diſſipated. The beſt way is to mix the oil and ſalt together moderately hot, and digeſt them in a low glaſs body for a day, then grind and digeſt them again. It is not of much importance to be curious about the proportions: if the ſalt predominates, the oil will the more readily and more perfectly unite with it, and when the union is obtained, the ſuperfluous ſalt may be ſeparated by deliquiation: the proceſs may be finiſhed by drawing over ſeveral times from the ſope ſome rectified ſpirit of wine, by which, if there is any redundant oil, it will be in good meaſure ſeparated. The other eſſential oils are ſtill more difficultly combinable with alcalies than that of turpentine; but empyreumatic oils unite more eaſily. Volatile alcalies do not form a ſope with any kind of oil: they only thicken expreſſed oils into the conſiſtence of a liniment; and it is only the ſpirit of ſal ammoniac made with quick-lime that does this.

Common hard ſope diſſolves in water, though not perfectly, by virtue of its alcaline ſalt. But it diſſolves alſo, and that in a more perfect manner, in rectified ſpirit of wine, though this menſtruum has no action either on the oil or the ſalt by themſelves: it is obſervable, that a ſmall proportion of ſope gives a quite thick conſiſtence to a very conſiderable quantity of the ſpirit. On adding any acid to a ſolution of ſope, its ingredients ſeparate from one another, the alcali being abſorbed by the acid, and letting go the oil. Sope is uſed medicinally as a detergent and deobſtruent: it diſſolves tenacious mucus, and promotes the natural excretions. If there are any medicines capable of diſſolving the calculus in the bladder, ſope is one of the principal. *Neumann's Chemiſtry.*

Almond SOAP, *Amygdalinus*, a new form of medicine got much into uſe of late in nephritic caſes, and made to ſupply the place of the common hard ſoap for internal uſes, in a more determinate manner for the phyſician, and a more cleanly one for the patient.

It is thus made:—Take any quantity of freſh oil of almonds, and thrice its quantity of ſoap lees; digeſt them together in ſuch a heat as will make them but juſt boil; within a few hours the oil and lees will be united, and the liquor will ſoon after become ropy, and ſomething tranſparent, and will cool into the conſiſtence of a jelly; then throw in ſea-ſalt till the boiling liquor has loſt its ropineſs; continue the boiling till, drops of the liquor being received upon a tile, the water is ſeen to ſeparate freely from the coagulated ſoap; then take away the fire, and the ſoap will riſe to the top of the water, and is to be taken off for uſe.

SOAP-EARTH, *Steatites*, a ſmooth unctuous kind of earth found in the Levant, and uſed as a ſope.

The ſope-earth, Dr. Smith tells us, is only had in two places near Duraclea, ſix leagues to the eaſt of Smyrna. It is in effect of itſelf a fine ſope, boiling and ſhooting up out of the earth.

It is gathered always before ſun-riſe, and in mornings when there falls no dew, ſo that a ſtock muſt be laid up in the ſummer months to ſerve all the year. In ſome places it comes up an inch or two above the ſurface of the ground, but the ſun riſing on it makes it fall again. Every morning there returns a freſh crop.

The people of Duraclea make ſoap with this earth in the following manner: they mix three-fourths of this earth with one fourth of lime, and then pour boiling water upon the mixture; they ſtir this with a ſtick, and there ariſes to the top a thick browniſh ſubſtance, which they ſcum off; they ſave this in veſſels by itſelf. They uſe both this and the clear liquor in making ſoap, but this is much ſtronger than the liquor. They put fifty kintals of oil into a large copper furnace, and, kindling a large fire under it, they let the oil boil a little, and then throw in, by little and little, firſt the ſcum of the ley, and afterwards the liquor itſelf; though ſometimes they uſe only the one, or only the other. They continue adding more and more of theſe till the oil acquires the conſiſtence of ſoap, which is often ſeveral days. The fire muſt be all this time kept up very ſtrong. The ſcum of the ley, and the ſtronger part of the ley itſelf, mix with the oil in the boiling, and the weaker part, unmixing itſelf, ſinks to the bottom, and is let out by a cock prepared for that purpoſe. This is not thrown away, but is let run upon freſh lime and earth, to make a ley for future uſe; and, when the ſoap is perfectly made, it is ladled out, and put upon a brick or lime floor to harden.

The common proportion, in the making the ſoap, is two loads of earth of five kintals each, to fifty kintals of oil, and the produce is between ſeventy and eighty kintals of ſoap. The earth is bought at a dollar a load, and the ſoap at ſix-pence half-penny a kintal. There are employed annually, in making ſoap at Smyrna, at leaſt ten thouſand kintals of oil. The bringing the ſoap earth to Smyrna employs a thouſand or fifteen hundred camels for eight months of the year, the four ſummer months being too hot for camels to travel in. A common ſoap-houſe produces, at a medium, a thouſand dollars a year clear profit. *Phil. Tranſ.* N°. 220.

There is great reaſon to believe that, when we know the proper manner of working, this will, one way or other, make a great ingredient in our porcelain manufactures.

The Chineſe have of late diſcovered a ſort of earth which they call hoache. They ſay that this is hard, ſmooth and ſoft to the touch, like ſoap; theſe, and its other qualities, ſeem to prove it to be the ſame with our ſoap-rock, and this, with them, makes a ſort of porcelain, ſuperior to the common kind in beauty, and in the compactneſs of its texture, but it is more apt to crack. They uſe it ſeveral ways, ſometimes alone, ſometimes with the petunſe, which is a ſtone; and ſometimes they make a varniſh, by diſſolving this in water, with which they coat over the common china, covering it finally with the other varniſh. All theſe ways of uſing it produce very beautiful wares, and it will be extremely worth our while to try them all round, before we give up the uſe of ſo valuable a thing. *Obſerv. ſur les Coutumes de l'Aſie.*

SOAR-HAWK, an appellation given to an hawk, from the time of taking her from the eyrie, till ſhe has mewed, or caſt her feathers.

SOCIETY, *Societas*, in general, denotes a number of perſons united together for their mutual aſſiſtance, ſecurity, intereſt, or entertainment.

The ſocial principle in man is of ſuch an expanſive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood: it ſpreads into wider ſyſtems, and draws men into larger communities and common-wealths; ſince it is in theſe only, that the more ſublime powers of our nature attain the higheſt improvement and perfection of which they are capable.

In ſociety, the mutual aids which men give and receive, ſhorten the labours of each; and the combined

ſtrength and reaſon of individuals give ſecurity and protection to the whole body. There is a variety of genius among mankind; ſome being formed to lead and direct others, to contrive plans of employment for individuals, and of government for communities, to invent laws and arts, and ſuperintend their execution, and in ſhort to refine and civilize human life: others again, who have not ſuch good heads, may have honeſt hearts, a true public ſpirit, love of liberty, order, &c. and finally, others ſeem beſt diſpoſed for manual exerciſes, as bodily labour. Society finds a proper employment for every genius, and the nobleſt objects and exerciſes for the nobleſt geniuſes. In ſociety, a man not only finds more leiſure, but better opportunities of applying his talents with ſucceſs.

From this ſhort detail it appears, that man was formed for ſociety; which reſts on theſe two principal pillars. 1. That it affords ſecurity againſt thoſe evils which are unavoidable in ſolitude. 2. That it enables us to obtain thoſe goods, ſome of which cannot be obtained at all, and others not ſo well, in a ſtate of ſolitude, wherein men depend wholly on their own ſagacity and induſtry.

Royal SOCIETY *of England*, is an academy or body of perſons of eminent learning, inſtituted by king Charles II. for the promoting natural knowledge. This illuſtrious body had its original in an aſſembly of ingenious men, who before the Reſtoration met weekly in Wadham college, at the lodgings of Dr. Wilkins.

Afterwards, from about the year 1658, many of them living in London, held meetings at Greſham college, till they were at length taken notice of by the king, who was pleaſed to grant them an ample charter, dated April 22, 1663; whereby they were erected into a corporation, conſiſting of a preſident, council, and fellows, for promoting the knowledge of natural things and uſeful experiments.

Their manner of electing fellows is by balloting. Their council are in number twenty-one, eleven of which are continued for the next year, and ten more added to them, all choſen on St. Andrew's day.

Each member at his admiſſion ſubſcribes an engagement that he will endeavour to promote the good of the ſociety; from which he may be freed at any time, by ſignifying to the preſident, that he deſires to withdraw.

The charges are forty ſhillings paid to the treaſurer at admiſſion, and thirteen ſhillings per quarter, ſo long as he continues a member.

Their deſign is to make faithful records of all the works of nature or art which come within their reach; ſo that the preſent, as well as after ages may be enabled to put a mark on errors which have been ſtrengthened by long preſcription, to reſtore truths that may have been neglected, to puſh thoſe already known to more various uſes, to make the way more paſſable to what remains unrevealed, &c.

To this purpoſe they have made a great many experiments and obſervations on moſt of the works of nature, eclipſes, comets, meteors, mines, plants, earthquakes, inundations, ſprings, damps, ſubterraneous fires, tides, currents, the magnet, &c. Alſo, numbers of ſhort hiſtories of nature, arts, manufactures, uſeful engines, contrivances, &c. The ſervices they have been of to the public are very great. They have improved naval, civil, and military architecture; advanced the ſecurity and perfection of navigation; improved agriculture; and put not only this kingdom, but alſo Ireland, the plantations, &c. upon planting.

They have regiſtered experiments, hiſtories, relations, obſervations, &c. and reduced them into one common ſtock, and have from time to time publiſhed ſome of the moſt immediate uſe under the title of Philoſophical Tranſactions, &c. and laid the reſt up in public regiſters to be tranſmitted to poſterity as a ſolid ground-work for future ſyſtems.

They have a library adapted to their inſtitution, towards which the late Marſhal contributed the Norfolcian library, and a muſæum, or repoſitory of natural and artificial rarities, given them by Daniel Colwal, Eſq; and ſince enriched by many others. Their motto is *Nullius in Verba*.

SOCIETY *for the Reformation of Manners*, and putting in execution the laws againſt immorality and profaneneſs. It was ſet on foot, about thirty years ago, by five or ſix private perſons in London, but is ſince exceedingly increaſed by numbers of all denominations. A particular body of the moſt conſiderable hereof bear the expence of proſecutions, &c. without any contribution from the reſt. Theſe chiefly apply themſelves to the proſecuting people for ſwearing, drunkenneſs, and prophaning the ſabbath. Another body, of about fifty perſons, apply themſelves to the ſuppreſſing lewdneſs, and by them above five hundred lewd houſes have been actually ſuppreſſed; a third body conſiſts of conſtables; and a fourth of informers. Beſides theſe, are eight other regular mixed bodies of houſe-keepers and officers, who inſpect the behaviour of the conſtables and other officers, aſſiſt in ſearching diſorderly houſes, ſeizing offenders, giving information, &c. There are ſeveral other ſocieties of this kind at Briſtol, Canterbury, Nottingham, &c.

SOCIETY *for propagating the Goſpel in foreign Parts*, was inſtituted by king William, in 1701, for ſecuring a maintenance for an orthodox clergy, and making other proviſions for the propagation of the Goſpel in the plantations, colonies, frontiers, &c. To that end he incorporated the archbiſhops, ſeveral biſhops, and other nobility, gentry, and clergy, to the number of ninety, with privilege to purchaſe two thouſand pounds per year, inheritance and eſtates for lives, or years, with other goods to any value.

They meet yearly on the third Friday in February, to chuſe a preſident, vice-preſident, and other officers; and the third Friday in every month to tranſact buſineſs, depute fit perſons to take ſubſcriptions for the ſaid uſes, and of all monies ſo received to give account to the lord chancellor, &c. They have a ſtanding committee at the chapter-houſe, to prepare matters for the monthly meeting, which is held at St. Martin's library.

SOCIETY *for propagating Chriſtian Knowledge*. This was begun in 1699, by ſome perſons of worth, &c. Its original deſign was to propagate religion in the plantations, to ſecure the pious education of the poor at home, and to reclaim thoſe that err in the fundamentals of Chriſtianity. In the year 1701, they had procured conſiderable charities, and tranſmitted the ſame to the plantations, in libraries, bibles, catechiſms, &c. with a voluntary maintenance for ſeveral miniſters to be employed in the plantations; but the Society for propagating the Goſpel in Foreign Parts being then inſtituted, they were incorporated by charter in the ſame, and thus diſcharged as a particular ſociety from the further purſuit of that branch of their original deſign, whereupon they wholly turned themſelves to the other, and are now very conſiderable by great acceſſions from the clergy and laity.

They meet weekly to concert meaſures for raiſing charity for educating poor children, and ſetting up ſchools for that purpoſe, as alſo for the more regular diſpoſal of books for the inſtruction of the ignorant, erroneous, &c.

SOCINIANS, in church hiſtory, a ſect of Chriſtian heretics, ſo called from their founder Fauſtus Socinus, a native of Sienna in Italy.

This hereſiarch, from his youth, gave proofs of a fine and extenſive genius: but the misfortune he had of imbibing very early the doctrines of Michael Servetus gave a wrong bias to his judgment. Being afraid leſt his opinions ſhould expoſe him to the ſeverities of the inquiſition, he left Italy, and retired into France. About the year 1574, he began openly to declare againſt the Catholic faith. At firſt he joined himſelf with Blandratus in Tranſylvania; and they both endeavoured to eſtabliſh, in that country, the doctrines of Servetus againſt the myſtery of the Holy Trinity, and all the other errors of that ſectariſt. The applauſes Socinus received from all the heretics who at that time infeſted Tranſylvania, flattered his vanity, and inſpired him with a deſign of eſtabliſhing a religion entirely new. He began with publiſhing, that Luther, Calvin, and other reformers, had indeed purged religion from many ſuperſtitions, which had been introduced into it, but that they had not entirely purified it. Afterwards he openly declared againſt the doctrine of the Trinity, and taught,

1. That

1. That the Eternal Father was the one only God; that the word was no more than an expreſſion of the godhead; and had not exiſted from all eternity: and that Jeſus Chriſt was God no otherwiſe than by his ſuperiority above all creatures, who were put in ſubjection to him by the Father. 2. That Jeſus Chriſt was not a mediator between God and men, but ſent into the world to ſerve as a pattern of their conduct; and that he aſcended up to heaven only, as it were, to take a journey thither. 3. That the puniſhment of hell will laſt but for a certain time, after which both body and ſoul will be deſtroyed. And, 4. That it is not lawful for princes to make war.

Theſe four tenets were what Socinus defended with the greateſt zeal: in other matters, he was a Lutheran or a Calviniſt. The truth is, he did but refine upon the errors of all the Anti-trinitarians who had gone before him.

The Socinians ſpread extremely in Poland, Lithuania, and Tranſylvania. Their chief ſchool was at Racow, and there all their firſt books were publiſhed. Their ſentiments are explained at large in their Catechiſm, printed ſeveral times under the title of *Catecheſis Eccleſiarum Polonicarum unum Deum patrem, illiuſque filium unigenitum, una cum Sancto Spiritu, ex ſacra ſcriptura confitentur.* They were exterminated out of Poland in 1655, ſince which time they have been chiefly ſheltered in Holland: where, though their public meetings have been prohibited, they find means to conceal themſelves under the names of Arminians and Anabaptiſts.

SOCLE, or ZOCLE, in architecture, a flat ſquare member under the baſes of pedeſtals of ſtatues, vaſes, &c. which ſerves as a foot or ſtand. Continued ſocle is a kind of continued ſtand or pedeſtal without either baſe or corniche, ranging round the whole building, called by Vitruvius ſtereobata.

SOCRATIC PHILOSOPHY, the doctrines and opinions, with regard to morality and religion, maintained and taught by Socrates. By the character of Socrates, left us by the ancients, particularly by his ſcholar Plato, Laertius, &c. he appears to have been one of the beſt and the wiſeſt perſons in all the heathen world. To him is aſcribed the firſt introducing of moral philoſophy, which is what is meant by that uſual ſaying, "That Socrates firſt called philoſophy down from heaven to earth;" that is, from the contemplation of the heavens and heavenly bodies, he led men to conſider themſelves, their own paſſions, opinions, faculties, duties, actions, &c.

SODA, or HEAT *of the Stomach*, in medicine, the name of a diſtemper conſiſting in a heat or troubleſome burning about the pit of the ſtomach, or its left mouth, which ſometimes is extended the whole length of the oeſophagus, with a preſſure or ſpaſmodic conſtriction, uſually attacking the patient by fits. The cauſe is generally fat aliment, eſpecially veal, if cold drink be taken ſoon after. In ſome it proceeds from acids, in others from aromatics, ſpirituous liquors, or bilious humours. This diſorder is generally ſlight, and vaniſhes of its own accord, though in others it is of long duration. In the cure, the cauſe muſt always be attended to; if from acids, abſorbents are proper, particularly crabs-eyes and prepared ſhells, mixed with a fourth or fifth part of powder of nutmeg given to half a dram, as alſo the tabellæ cardialgicæ. It is common to take chalk alone or mixed with nutmeg; but care ſhould be taken not to be too free in its uſe. Oil of tartar per deliquium, given from twenty to thirty drops in coffee, tea, broth, or warm beer, is generally efficacious, as alſo tincture of tartar and ſpirit of hartſhorn. If it proceeds from bilious humours, thirty or fifty drops of dulcified ſpirit of nitre in water, tea, or coffee, will take away the pain. When it is cauſed by fat things and draughts of cold liquor, a dram of brandy is good. Now and then laxatives ſhould be given to carry off the humours. In ſanguine conſtitutions, bleeding may be proper.

SOFA, in the Turkiſh cuſtoms, a kind of alcove, raiſed half a foot above the floor of a chamber or other apartment, and eſteemed the place of ſtate where viſitors of diſtinction are received.

SOFFITA, or SOFFIT, in architecture, any timber cieling, formed of croſs beams of flying corniches, the ſquare compartments or pannels of which are enriched with ſculpture, painting, or gilding; ſuch are thoſe in the palaces of Italy, and in the apartments of Luxembourg at Paris. This word is particularly uſed for the under ſide or face of an architrave, and for that of the corona or larmier, which the ancients called lacunar, the French plafond, and we uſually the drip. It is enriched with compartments of roſes, and has eighteen drops in the Doric order diſpoſed in three ranks, ſix in each, placed to the right-hand of the guttæ, and at the bottom of the triglyphs.

SOFTENING, in painting, the mixing and diluting of colours with the bruſh or pencil. To ſoften deſigns in black and white made with the pen, &c. ſignifies to weaken the tint. To ſoften a portrait, according to Felibien, is to change ſome of the ſtrokes, and give a greater degree of ſweetneſs and ſoftneſs to the air thereof, which before had ſomething rough and harſh in it.

SOIL, *Solum*, in agriculture and gardening, denotes earth or ground conſidered with regard to the quality of its mould for the product and growth of vegetables.

Mr. Bradley reduces all ſoils to three heads, viz. ſand, loam, or mother-earth, and clay.—Gravels, and all the open ſoils till we come at loam, are of the ſandy race; and the binding earths from loam, down to the ſtiffneſs of chalk, may be ranged under the clay kind.

Loam, or mother-earth, is the medium between the two, and includes all the intermediate kinds.

Each of theſe ſoils tends likewiſe to vegetation, and each has its ſalts proper thereto; but in different proportions, a peck of clay having twice as much ſalts in it as the ſame quantity of loam, and four times as much as ſand.

Now, it is found to be the ſalts or juices of the ſoil, not the earth itſelf, that plants are fed and ſubſiſted by. For, in many experiments of vegetation where plants of fifteen or twenty pounds weight have been produced, there has been no ſenſible diminution of the weight of the earth.

Hence, at firſt, it would ſeem that clay were moſt proper, and ſand the leaſt proper ſoil, to promote the growth of plants, which is contrary to experience. The reaſon is, that the parts of clay, being cloſe wrought together, do not ſo eaſily give out their ſalts, nor can the tender fibres of many plants make their way through it in ſearch of their food. But, if its parts be well opened by digging and breaking it into very ſmall pieces, and thoſe parts be kept open by a mixture of ſharp ſand, or other like matter, that author adds, we ſhall ſee the effect of its vigour; ſand, on the other hand, giving its ſalts readily, puts forth its plants very eaſily, and will make them generate a full month ſooner than clay; but, as it is haſty, it is ſoon ſpent. The ſun's warmth calls up all its warmth early in the ſpring, and there is but little left for them to ſubſiſt long on, if the heat continue.

The land of England, as conſidered by the farmer, is reduced into nine ſorts of ſoils; the ſandy, the gravelly, the chalky, the ſtony, the rocky, the hazely, the black earth, the marſh, and the clay land. Of this kind there are four varieties, diſtinguiſhed by their colours: the black, the blue, the yellow, and the red. In many places theſe ſoils are mixed and blended together, and where it is ſo, it is much better than where they are ſeparate or ſingle; eſpecially where the mixtures happen to be of a right kind, as thoſe of the hot and dry ſoils blended with the cold and the moiſt. Nature does this often, and art may imitate it. All ſands are hot, and all clays are cold; and therefore the laying clay upon ſandy lands, or ſand upon clayey lands, is the beſt of all manure: this alters and changes for the better the very nature of the land itſelf, whereas dung only improves it for a time, and after that leaves it as bad as it was before. Mixed ſoils, that tend to the clayey kind, are the beſt of all others for corn. It is not only the natural ſoil we are to conſider, but the depth of it, and what ſoil is underneath; for the richeſt ſoil, if it be only eight or ten inches deep, and lies upon a cold clay, or upon ſtones, will not be ſo fruitful to the farmer as the leaner ſoils that lie upon better under ſtrata. Gravel

or

or ſand are the beſt under-ſtrata, of all others, to make the land above prolific.

Cold and wet clays are much more fruitful in the ſouthern parts of England, than in the north. The climates, therefore, are to be conſidered, and the quantities or proportions of the different kinds in the mixed ſoils. The natural produce of the land, as to weeds or graſs, is alſo to be greatly regarded by the perſon who intends to improve upon it.

What is the effect of plowing is next to be enquired into, and experiment muſt ſhew what kind of corn agrees beſt with it.

All land that moulders into duſt with froſt, with all ſorts of warm lands, black mould, yellow clays, if not too ſpewy when wet, and all that turn black after rain, are in general good lands for corn. Land that produces large trees, as alſo ſuch as produces black-thorn, weeds, thiſtles, rank graſs, and the like, and that lies in bottoms open to the eaſt or ſouth, being well ſheltered from the other winds, may be always eſteemed to bid fair for good land. Thyme, ſtrawberries, betony, and wild ſage, direct to the places where wood will thrive beſt; and camomile is always an indication of a land being diſpoſed to bear corn in large crops.

All land that binds after froſt and rain, all that turns white, and is full of worms, or is very moiſt and cold, or that is too hot and dry, and that lies open to the north on the ſides of hills, expoſed to cold winds and froſts in winter, and to the ſun's ſcorching heat in ſummer; and all that bears naturally holly, box, ivy, juniper, fern or brakes, furzes, broom, and heath; and lands that bear moſſes, ruſhes, yarrow, and wild tanzy, with flags, and other ſuch weeds, which betoken a cold and damp ground; are leſs fit for corn, though other things may ſucceed on it. Where plants appear blaſted, ſhrubby, and curled, theſe are diſtempers in them occaſioned by ſudden changes of wet and cold, and a dry heat. All theſe lands are, by their natural produce, to be judged leſs fruitful than the others. Blackiſh, dun, or yellow land, and very hot ſtony gravel, are generally eſteemed very unfruitful. Chalky lands are naturally cold, and therefore they require warm compoſts; and this is the reaſon why chalk itſelf is ſo good a manure for hot and dry land. Sandy land, well manured with marl, will bear turnips, or white or blue peaſe, to great advantage. *Mortimer's Huſbandry.*

The ſupply of freſh vegetable matter, in the place of that which was drained away by the ſucceſſive growths of plants, is done by ſeveral ways, but by none ſo well, as by letting it lie fallow for ſome time; in this caſe the rain falling upon it, the vegetable earth, which this water contains, is depoſited in ſufficient quantity, and this is alone ſufficient to give nutriment to new crops; and it is proved by this, that the rain water, as well as other water, does contain ſuch earth as is neceſſary to vegetation. The other means of giving a ſupply to the exhauſted earth are the manures laid on it by the farmer, and theſe are, all of them, ſome animal or vegetable remains, and their uſe is to drain into the earth thoſe particles from themſelves, which may be again received into the bodies of new productions of the ſame kinds. Blood, urine, the excrements of animals, with their ſeveral parts, as horns, hoofs, hair, feathers, calcined ſhells, and vegetable bodies in an altered ſtate, ſuch as lees of wine and beer, aſhes of burnt vegetables, leaves, ſtraw, roots, ſtubble, and the like, when in a decaying ſtate, turned under the earth again by plowing, there become diſunited into their component parts, and theſe again are carried up into other new plants.

If we take off our thoughts from the fields, and look among the gardens, we there meet with farther confirmations of the ſame thing; the trees, ſhrubs, and herbs cultivated in theſe, after they have continued in one ſtation, till they have derived thence the greater part of the matter fitted for their increaſe and nouriſhment, will either decay, or degenerate, unleſs they have a new ſupply of manure added to the earth about their roots, or are themſelves tranſlated into other earth, not ſo drained of that particular matter out of which they are to be fed.

The older trees have ſome more ſupplies of fit matter than the younger, by means of the length of their roots, which, when they have drained one ſpot of ground, uſually are carried much farther into another, and reach a very great way; but at laſt they can reach no farther, and all fails, unleſs ſuch a ſupply of manure, or the being removed into freſh earth, ſupply that nouriſhment they can no longer have where they ſtand. The gardeners, when they tranſplant trees, cut off theſe long roots; but, though they only do this to prevent the trouble of opening a larger hole than neceſſary for their reception, yet there is in nature this good reaſon for it, that they have, when brought to a freſh ſoil, no occaſion for thoſe long roots to draw nouriſhment from afar off, when there is enough of it every-where about them. What is to be learned from the whole of this, is, that the modern ſyſtem is erroneous, which ſays, that water is the only thing that gives nouriſhment and increaſe to plants; ſince, if this was the caſe, there could be no need of manures, nor any need of altering the crop, in order to its ſucceeding, or of tranſplanting trees to make them thrive. It is plain that ſome ſort of terreſtrial matter, taken from among the ſoil, is what gives increaſe and bulk to plants; for where it is only water, the rain falling in all places alike, all would alike be at all times ſuited to produce all plants; and if the earth, according to Lord Bacon's ſyſtem, ſerved to no other purpoſe to plants and trees, but to keep their roots firm, and to defend them from theſe uſes as another, and the ſame earth would do as well for over-heat, and over-cold, one earth would do as well for the ſame plant as a different earth. *Phil. Tranſ.* N°. 253.

Brickiſh SOIL, a term uſed by our farmers to expreſs a kind of hazely earth or land, with a reddiſh caſt. It is frequent in Eſſex, and ſome other counties, and approaches to the nature of a loam. It has no ſtones in it, and does not bind after wet as clay does, but lets all the water in that comes, and has no ſlates in it; whereas all clays hold the water till the ſun exhales, and, after rain, with a froſt, moulder into duſt.

Theſe loams are an excellent mixture for other earths, being a happy medium between two extremes, uniting what is too looſe, cooling what is too hot, and entertaining a moderate ſhare of moiſture.

The beſt produce of the brick earth is rye; if well dunged, it will bear white oats, turnips, barley, wheat, buck-wheat, and peaſe. The natural produce, in weeds, is broom, fern, quick-graſs, and the like. If it be well dunged, it will produce large crops of clover, but it ſoon wears out of it, and ſhould therefore be ſowed mixed with rye-graſs.

The beſt manure for theſe lands is chalk, mixed with coal aſhes: marl makes a great improvement in them, and there is a ſtiff yellow kind of clay, that moulders with the froſt, that anſwers the ſame purpoſe. Whatever amendment is beſtowed upon this ſort of land by dung, and other enriching things, that do not abſolutely alter the nature of the earth, laſts but a little while. Theſe lands bind very much after rain, and turn whiter; no froſt will diſſolve the clod, and if they are new ploughed up, and never ſo much rain comes on them, people may walk or ride over them almoſt as firm as over gravel. If they are not frequently ploughed, they are very ſubject to worms, which deſtroy the winter corn. They yield but poor crops in wet years; the weeds are generally very rank, and the wheat runs all into ſtraw. Ploughing is a great improvement of them; they always grow well the year after it. Theſe lands are to be ordered for corn in the ſame manner with the clay land, only as they are rank, and carry the crops much into ſtraw, it is beſt to dung them on the etch crop, and to ſow them with barley, and never to dung the fallows. Where the farmer has not an inclination to plow them, but keep them for graſs, they ſhould be mowed one year, and then kept ſhort fed with ſheep, which will in time ſweeten them very much.

The red ſandy lands in Northamptonſhire are of this kind; they will not hold manure, ſo they plough but once for the year's crop, which is juſt before the ſowing-time, and manure juſt before they plough it; for if they plough it oftener, and manure it ſooner, they find a great quantity of the beſt mould waſhed away below the ſurface, and out of the reach of the roots of the corn.

In Oxfordſhire they have a ſort of red land, which they begin fallowing as ſoon in the year as they can, before the ſun is too high: if it is moderately moiſt, when fallowed, they eſteem it the better, but it ſhould not be too wet. They ſeldom give it a ſecond ſtirring, and they reckon that, if it is too fine and light, it runs to weeds. *Mortimer's Huſbandry.*

SOIT *Fait Il Eſt Deſiré, be it done as it is deſired*, a form uſed when the king gives the royal aſſent to a private bill preferred in parliament.

SOL, or SOU, a French coin made up of copper mixed with a little ſilver. See the article EXCHANGE

SOL, the ſun, in aſtronomy, aſtrology, &c. See the article SUN.

SOL, in chemiſtry, is gold, thus called from an opinion that this metal is in a particular manner under the influence of the ſun. See GOLD.

SOL, in heraldry, denotes or, the golden colour in the arms of ſovereign princes.

SOLÆUS, or SOLARIS, in anatomy, one of the extenſor muſcles of the foot, riſing from the upper and hinder part of the tibia and fibula. This is a large and fat muſcle, thicker at the middle than at the edges, and is nearly of an oval figure.

SOLANUM, NIGHT-SHADE, in botany, a genus of plants, the corolla whereof conſiſts of a ſingle rotated petal; the fruit is a round ſmooth berry, punctuated at the top, and formed into two cells; the receptacle is fleſhy and convex on both ſides; and the ſeeds are numerous and roundiſh.

This genus comprehends the ſolanum, melongena, and lycoperſicon of authors; or the common night-ſhade, the woody night-ſhade, the love-apple, and the mad-apple, &c.

Common night-ſhade is uſed to allay inflammations, to ſoften and relax the fibres which undergo too violent a tenſion; they apply the bruiſed herb to the piles, or bathe the part with the juice a little warmed: this juice is ſaid to be proper in wounds where the blood is extravaſated and grumous: it is alſo ſudorific and diuretic, expelling gravel from the kidneys.

SOLAR, ſomething belonging to the ſun: thus the ſolar ſyſtem is that ſyſtem of the world wherein the heavenly bodies are made to revolve round the ſun as the center of their motion.

Alſo the ſolar year is that conſiſting of three hundred and ſixty-five days, five hours, and forty-nine minutes, in oppoſition to the lunar year, conſiſting of three hundred and fifty-four days.

For the ſolar month, ſolar cycle, ſolar eclipſe, &c. ſee the articles MONTH, CYCLE, ECLIPSE, &c.

SOLDER, SODDER, or SODER, a metallic or mineral compoſition uſed in ſoldering or joining together other metals.

The word is formed from the French, *ſoudare*, and from the Latin, *ſolidare*, to ſtrengthen.

Solders are made of gold, ſilver, copper, tin, biſmuth, and lead; uſually obſerving, that in the compoſition there be ſome of the metal that is to be ſoldered mixed with ſome higher and finer metals. Goldſmiths uſually make four kinds of ſolder, viz. ſolder of eight, where to ſeven parts of ſilver there is one of braſs or copper; ſolder of ſix, where only a ſixth part is copper; ſolder of four, and ſolder of three. It is the mixture of copper in the ſolder that makes raiſed plate come always cheaper than flat. The ſolder uſed by plumbers is made of two pounds of lead to one of block-tin. Its goodneſs is tried by melting it and pouring a ſmall quantity upon a ſtone; for if good, there will ariſe little bright ſhining ſtars therein. The ſolder for copper is made like that of the plumbers, only with copper and tin; for very nice works, inſtead of tin they ſometimes uſe a quantity of ſilver. Solder for tin is made of two thirds of tin and one of lead; but where the work is any thing delicate, as in organ pipes, where the juncture is ſcarce diſcernible, it is made of one part of biſmuth and three parts of pewter.

SOLDERING, among mechanics, the joining and faſtening together two pieces of the ſame metal, or of two different metals, by the fuſion and application of ſome metallic compoſition on the extremities of the metals to be joined. See the laſt article.

To ſolder upon ſilver, braſs or iron: take ſilver, five penny-weight; braſs, four penny-weight; melt them together for ſoft ſolder, which runs ſooneſt. Take ſilver, five penny-weight; copper, three penny-weight; melt them together for hard ſolder. Beat the ſolder thin, and lay it on the place to be ſoldered, which muſt be firſt fitted and bound together with wire, as occaſion requires; then take borax in powder, and temper it like pap, and lay it upon the ſolder, letting it dry; then cover it with quick coals, and blow, and it will run immediately; take it preſently out of the fire, and it is done. It is to be obſerved, that if any thing is to be ſoldered in two places, which cannot well be done at one time, you muſt firſt ſolder with the harder ſolder, and then with the ſoft; for if it be firſt done with the ſoft, it will unſolder again before the other is ſoldered. Let it be obſerved, that if you would not have your ſolder run about the piece that is to be ſoldered, you muſt rub ſuch places over with chalk.

In the ſoldering either of gold, ſilver, copper, and all the metals before-mentioned, there is generally uſed borax in powder, and ſometimes roſin. As to iron, it is ſufficient that it be heated red-hot, and the two extremities thus hammered together, by which means they will become incorporated into one another.

SOLDIER, a military man liſted to ſerve a prince or ſtate, in conſideration of a certain daily pay.

The ſoldiers are properly the land forces of a kingdom or ſtate; but in England it is againſt the ancient law to keep an army of ſoldiers in time of peace. Where any ſoldier that is lawfully retained ſhall depart from his colours without licence, he is declared to be guilty of felony by 18 Hen. VI. c. 9. and every ſoldier who either cauſes a mutiny or deſerts the ſervice, ſhall be puniſhed with death or otherwiſe, as a court martial ſhall think fit. Alſo perſons ſuſpected of deſertion, are to be apprehended by conſtables, who ſhall be allowed a reward of 20s. for every ſuch deſerter.

By the 4 Geo. I. c. 4. it is ordained, that no ſoldier ſhall be taken out of the ſervice by any proceſs at law, unleſs it be for ſome criminal matter, or where the debt he owes amounts to 10l. at the leaſt, of which affidavit is to be made, &c. Soldiers muſt be quartered in inns and alehouſes only, and not in private houſes, without the conſent of the owners, under certain penalties: and where victuallers refuſe ſoldiers quartered on them, or conſtables receive any reward for excuſing their neglect, they forfeit a ſum not above 5l. nor under 30s. by 3 Geo. II. c. 2. A perſon inliſted for a ſoldier, within four days after, is to be carried before the next juſtice or chief magiſtrate of a town, and is to declare his aſſent that he liſted voluntarily, &c. but if he then diſſents thereto, on his returning the money received, and paying 20s. he may be diſcharged. In caſe any ſubject of Great Britain or Ireland ſhall liſt or enter himſelf, or procure any one to be enliſted a ſoldier to go beyond the ſeas, without leave obtained from his majeſty, ſuch perſon ſhall be puniſhed as a felon by 8 and 9 Geo. II. There are acts annually made for puniſhing mutiny, &c. of ſoldiers and falſe muſters, and for the better payment of the army and their quarters, &c.

SOLE, in the manege, a nail or ſort of horn under a horſe's foot, which is much more tender than the other horn that incompaſſes the foot, and by reaſon of its hardneſs is properly called the horn or hoof. A horſe's ſhoe ought to be ſo ſet upon the hoof as not to bear upon the ſole, for otherwiſe the ſole would be hurt, and not only make the horſe lame, but corrupt the fleſh that ſeparates it from the coffin-bone. To take out the ſole, is to do it without touching the horn of the hoof; or if you take off the horn, you make a hoof-caſt.

SOLECISM, *Solœciſmus*, in grammar, a falſe manner of ſpeaking, contrary to the uſe of language and the rules of grammar, either in reſpect of declenſion, conjugation, or ſyntax.

SOLEMN, *Solennis*, ſomething performed with much pomp, ceremony, and expence: thus we ſay, ſolemn feaſts, ſolemn funerals, ſolemn games, &c.

In law, ſolemn ſignifies ſomething authentic, or that is cloathed in all its formalities.

SOLFAING, in muſic, the naming and pronouncing of the ſeveral notes of a ſong, by the ſyllables ſol, fa, la, &c. in learning to ſing it.

Mr. Malcolm obſerves, that the practice of ſolfaing, common as it is, is very uſeleſs and inſignificant either as to the underſtanding or practiſing of muſic, yet exceedingly perplexing. The various applications of the ſeveral names according to the various ſignatures of the clef, are enough to perplex any learner: there being no leſs than ſeventy-two different ways of applying the names ſol, fa, &c. to the lines and ſpaces of a particular ſyſtem.

SOLID, in philoſophy, a body whoſe minute parts are connected together, ſo as not to give way, or ſlip from each other upon the ſmalleſt impreſſion.

In geometry, ſolid is the third ſpecies of magnitude, having three dimenſions, viz. length, breadth, and depth.

A ſolid may be conceived to be formed by the revolution, or direct motion, of a ſuperficies of any figure whatever, and is always terminated or contained under one or more planes or ſurfaces, as a ſurface is under one or more lines.

Solids are commonly divided into regular and irregular. The regular ſolids are thoſe terminated by regular and equal planes, and are only five in number viz. the tetrahedron, which conſiſts of four equal triangles; the cube or hexahedron, of ſix equal ſquares; the octahedron, of eight equal triangles; the dodecahedron, of twelve; and the icoſihedron, of twenty equal triangles.

The irregular ſolids are almoſt infinite, comprehending all ſuch as do not come under the definition of regular ſolids; as the ſphere, cylinder, cone, parallelogram, priſm, parallelopiped, &c.

SOLID *of leaſt Reſiſtence.* Sir Iſaac Newton, in his Principia, ſhews, that if there be a curve figure, as DNFG (plate CXXI. *fig.* 10.) of ſuch a nature, as that from any point, as N, taken in its circumference, a perpendicular NM be let fall on the axis AB; and if from a given point, as G, there be drawn the right line GR, parallel to a tangent to the curve in the point N, cutting the axis produced in R, and the proportion then be, as $NM:GR :: GR^3:4BG \times GR$; the ſolid generated by the revolution of this curve about its axis AB, when moved ſwiftly in a rare and elaſtic medium, will meet with leſs reſiſtence from the medium, than any other circular ſolid whatever, of the ſame length and breadth.

SOLID ANGLE, is that formed by three or more planes meeting in a point, like the point of a diamond well cut.

SOLID BASTION. See BASTION.

SOLID NUMBERS, are thoſe which ariſe from the multiplication of a plane number, by any other whatſoever; as 18 is a ſolid number made of 6 (which is plane) multiplied by 3; or of 9 multiplied by 2;

SOLID PROBLEM, in mathematics, is one which cannot be geometrically ſolved unleſs by the interſection of a circle and a conic ſection: or, by the interſection of two other conic ſections, beſides the circle.

As to deſcribe an iſoſceles triangle on a given right line, whoſe angle at the baſe ſhall be triple to that at the vertex.

This will help to inſcribe a regular heptagon in a given circle; and may be reſolved by the interſection of a parabola, and a circle.

This problem alſo helps to inſcribe a nonagon in a circle; and may be ſolved by the interſection of a parabola, and an hyperbola between its aſymptotes, viz.

To deſcribe an iſoſceles triangle, whoſe angle at the baſe ſhall be quadruple of that at the vertex.

And ſuch a problem as this hath four ſolutions, and no more; becauſe two conic ſections can cut one another but in four points.

Line of SOLIDS, on the ſector. See the article SECTOR.

SOLIDS, in anatomy, &c. denote the continent parts of the human body; being a congeries of pipes, or veſſels, which contain a liquor.

The ſolid parts of the body, though equally compoſed of veſſels, are different with regard to their conſiſtence; ſome being hard, and others ſoft. The hard, as the bones and cartilages, give firmneſs and attitude to the body, and ſuſtain the other parts: the ſoft parts, either alone, or together with the hard, ſerve to execute the animal functions.

The ſolids are commonly divided into ſimilar or ſimple; and diſſimilar, compounded, or organic. The ſimilar parts are the fibres, membranes, bones, cartilages, ligaments, muſcles, tendons, aponeuroſes, glands, arteries, veins, nerves, the ſecretory and excretory canals, and the common integuments.

The diſſimilar are ſuch as are compoſed of the former, as the viſcera and other parts of the body, viz. the head, neck, thorax, abdomen, and extremities: every one of which is again ſubdivided into leſſer portions.

SOLIDITY, *Soliditas*, in phyſics, a property of matter or body, whereby it excludes every other body from that place which itſelf poſſeſſes.

Among geometricians, the ſolidity of a body denotes the quantity or ſpace contained in it, and is called alſo its ſolid content.

SOLIDITY, in architecture, is applied both to the conſiſtence of the ground whereon the foundation of a building is laid; and to a maſs of maſonry of extraordinary thickneſs, without any cavity therein.

SOLILOQUY, *Soliloquium*, a reaſon or diſcourſe which a man holds with himſelf.

Papias ſays, that ſoliloquy is properly a diſcourſe by way of anſwer to a queſtion that a man has propoſed to himſelf.

Soliloquies are become very common on the modern ſtage, yet nothing can be more inartificial or more unnatural than an actor's making long ſpeeches to himſelf to convey his intentions, &c. to the audience.

SOLITARY, *Solitarius*, ſomething retired, or in private, remote from the company or commerce of others of the ſame ſpecies.

SOLITARIES, a denomination of nuns of St. Peter of Alcantara, inſtituted in the year 1676, the deſign of which is to imitate the ſevere penitent life of that ſaint: thus they are to keep a continual ſilence, never to open their mouths to any body but themſelves; employ their time wholly in ſpiritual exerciſes, and leave the temporal concerns to a number of maids, who have a particular ſuperior in a ſeparate part of the monaſtery; they always go bare-footed, without ſandals; gird themſelves with a thick cord, and wear no linen.

SOLSTICE, in aſtronomy, that time when the ſun is in one of the ſolſtitial points; that is, when he is at his greateſt diſtance from the equator, thus called, becauſe he then appears to ſtand ſtill, and not to change his diſtance from the equator for ſome time; an appearance owing to the obliquity of our ſphere, and which thoſe living under the equator are ſtrangers to.

The ſolſtices are two in each year, the æſtival or ſummer ſolſtice, and the hyemal or winter ſolſtice: the ſummer ſolſtice is when the ſun ſeems to deſcribe the tropic of Cancer, which is on the 22d of June, when he makes the longeſt day: the winter ſolſtice is when the ſun enters the firſt degree, or ſeems to deſcribe the tropic of Capricorn, which is on the 22d of December, when he makes the ſhorteſt day.

This is to be underſtood as in our northern hemiſphere; for in the ſouthern, the ſun's entrance into Capricorn makes the ſummer ſolſtice, and that into Cancer the winter ſolſtice.

The two points of the ecliptic, wherein the ſun's greateſt aſcent above the equator, and his deſcent below it, are terminated, are called the ſolſtitial points; and a circle, ſuppoſed to paſs through the poles of the world and theſe points, is called the ſolſtitial colure.

The ſummer ſolſtitial point is in the beginning of the firſt degree of Cancer, and is called the æſtival or ſummer point; and the winter ſolſtitial point is in the beginning of the firſt degree of Capricorn, and is called the winter point. Theſe two points are diametrically oppoſite to each other.

SOLVENT, the ſame with diſſolvent. See the article DISSOLVENT.

SOLUTION, in pharmacy, conſidered as an operation, is the commixing ſolid bodies with fluids in ſuch a manner

manner that, commenſtruating, they ſhall be thereby alſo converted to fluidity, and the whole rendered one equable ſimilar fluid.

The intentional ends of ſolution are ſometimes only the procuring a fluid form of the matter diſſolved without any farther change either in that or the ſolvent; as in the ſolution of ſalts, gums, reſins, &c. where the menſtruum is to be conſidered only as a vehicle: at others, the producing new combinations of ſuch bodies, as, when thus compounded, either acquire properties which they had not, while ſeparate, or loſe ſuch as they then poſſeſſed, as in the inſtances of fixed alcaline or volatile ſalts diſſolved in vinegar, to form the ſal diureticus, or Mendereus's mixture or ſpirit as it is called; where the acid or alcaline qualities of the ingredients are loſt, and a neutral ſalt, with peculiar qualities, is produced. Solution is alſo indiſpenſably requiſite in order to the cryſtallization of ſalts.

As the nature of ſolvents or menſtrua, as well as the bodies required to be diſſolved, are extremely various, the manner of effecting ſolutions is conſequently different. In many caſes a ſimple commixture, ſupported by frequently ſhaking the veſſel, if ſmall, or ſtirring the contents, if larger, is found ſufficient: in others the aid either of a digeſtive or boiling heat is abſolutely neceſſary. Sea ſalt, nitre, all the vitriolic ſalts, ſal ammoniacum, allum, ſoluble tartar, ſugar, vitriolic tartar, crude tartar, where a ſtrong ſolution is not required, fixed alcaline and volatile ſalts, all the gums ſoluble in water, camphire, ſal diureticus, nearly all the reſins therein ſoluble, in ſpirit of wine, and metals in their proper menſtrua, may be diſſolved cold, though not with equal expedition, as when heat is employed.

Calces of metals and mercury in acid ſpirits; mercury ſublimate in water; and ſeveral of the hardeſt gum reſins are beſt diſſolved in the heat of digeſtion.

Allum, Glauber's ſalts, vitriolate tartar, where the ſolution is not intended to be very weak; borax, and all other ſalts where a ſtrong ſolution is demanded, and iſinglaſs, require to be boiled.

Solution is much facilitated by the powdering ſuch tenacious bodies as are friable, or ſlicing or raſping into ſmall parts, ſuch whoſe texture admit not of being powdered; and this is in ſome caſes of ſuch importance, that the operation is extremely tedious, if it be neglected.

In ſolutions of metals, earths, or ſalts in acid ſpirits, care ſhould be taken that they be not mixed too haſtily; otherwiſe the ebullition will occaſion the mixtures to overflow the veſſels, or, in ſome inſtances, an unmanageable heat and ſuch noxious fumes will enſue, as give great embarraſſment to the operator. The form of the veſſels is not material in this operation, unleſs where digeſtion is required, in which caſes the rules given for that operation are to be obſerved: but the ſubſtance of the containing veſſel is to be regarded, leſt from the action of the menſtruum it may either be damaged or the medicine depraved.

Beſides the ſolutions made by the adding fluids to bodies to be diſſolved, there is another kind called deliquiation, or ſolution per deliquium. It is performed by expoſing the matter to the air, from which attracting water it collects in time a ſufficient quantity to diſſolve itſelf. Cellars, or other damp places, are the moſt proper for this purpoſe. But as the produce of this kind of ſolution is no other than may be obtained in the common way, by adding the ſame quantity of water as the matter by this means collects, it merits more to be totally rejected than improved. There are however two proceſſes on this principle retained in the new college Pharmacopœia, under the names of lixivium tartari, and lixivium martii.

No phænomenon in nature is more univerſally known, than the ſolution of ſalts in common water; but the world has not yet attended to all that might be learned from the obſervations on it.

Mr. Lemery, who examined into this point with aſſiduity, has obſerved, 1. That the firſt effect of water upon a ſalt is the reducing it into an inexpreſſibly fine powder. 2. That it is merely the conſequence of this pulverization carried greatly farther, that every particle of ſalt which, while in larger moleculæ, ſubſided to the bottom of the water, according to the known laws of hydroſtatics, becomes capable of being elevated and ſuſpended in the water, though in itſelf greatly heavier than that fluid; that, while in a proper ſtate of ſeparation in this manner, they remain imperceptible in all the water, and when by certain accidents they again approach one another, they form concretions like their original ones, and again ſubſide in that fluid, in which they floated while in form of this imperceptible powder.

In the ſolutions of ſalts, the ſame author obſerves, that all the particles of water do not ſerve to the ſame purpoſe; ſome officiating only in the keeping the ſaline particles ſuſpended, others in the keeping them aſunder, and, as barriers, preventing their reunion.

The quantity of water neceſſary to ſuſtain the particles of all ſalts in ſolution, is the ſame; but the quantity required to keep thoſe particles from joining again, is different, in regard to every ſalt. Hence, though a quantity of water, equal to the weight of the ſalt, be ſufficient to the ſuſpenſion of its particles, yet every ſalt requires its own appropriated quantity of water to keep it in a ſtate of ſolution, that is, to keep its particles from cohering together again. In ſuch ſalts, the particles of which are not ſubject to form hard concretions, ſuch as the fixed ſalt of tartar, and the like, there requires no more water for a ſolution than is neceſſary to ſuſpend the particles of the ſalt; but in thoſe which readily form ſolid concretions, ſuch as common ſalt, nitre, borax, and the reſt, there requires a large quantity beſides to act as a barrier.

The more the particles of any ſalt are diſpoſed to reunite, the more water they require to keep them in a ſtate of ſolution; and hence follows a very remarkable phænomenon, which is the ſolution of ſeveral ſalts ſucceſſively in the ſame water: this is known to be poſſible, and the reaſon of the whole is this, that when a given ſalt, requiring a large quantity of water for its ſolution, is diſſolved in that water; the greater part of that water, which in this ſolution ſerves only to the ſecond purpoſe of keeping the particles of the ſalt aſunder, is ſtill at full liberty to act as water upon another ſalt that ſhall be thrown into it.

This, however, can be only the caſe in regard to ſalts which do not naturally ferment with one another, becauſe the whole proceſs is diſturbed by ſuch a fermentation, and, in conſequence of it, there is a third ſalt formed, which is not the ſame with either of the two; and the conſequence of the formation of this ſalt is the precipitation of the metallic or earthy matter, which was the baſe of one of the other ſalts.

Thus an alkaline ſalt, added to a ſolution of alum, or ſaccharum ſaturni, takes up the acid of either of theſe ſalts, and becomes, by its mixture with that acid, a new concrete ſalt, and at the ſame time throws down, in precipitation, the terreſtrial baſe of the alum, and the metallic one of the ſalt of lead. To return to thoſe ſalts which excite no fermentation with one another. In regard to theſe, when a quantity of water has diſſolved as much as it can retain of one, it will readily take in and diſſolve a ſecond; and the particles of this, not fermenting with thoſe of the ſalt firſt diſſolved, will remain ſuſpended, and the water which diſſolves them, and which in the firſt ſolution ſerved only as an intermedium to keep the particles of that ſalt aſunder, ſerve as well to that purpoſe, now they are impregnated with this new ſalt, as they did before.

It is well known that ſalt of tartar does not ferment with ſalt-petre, nor does it take any thing from this ſalt, or at all alter by being mixed with it, which is quite different from the effect on mixing it, as before obſerved, with alum, or ſaccharum ſaturni; on this principle, and on the known property of ſalt of tartar being diſſolved in a ſmaller quantity of water than any other ſalt; or, in other words, of water's diſſolving more ſalt of tartar than any other ſalt, Mr. Lemery reſolved, on the trial, whether water which had already diſſolved as much nitre as it could contain, would not, on the addition of ſalt of tartar, diſſolve a larger quantity of freſh nitre, than on the addition of ſal armoniac, or any

other

other ſalt: but what appeared very ſtrange was, that after two days ſtanding of a ſolution of nitre, with about a fourth part of the quantity of ſalt of tartar added, there was found a white powder at the bottom. The liquor, being examined on this, was found to be a lixivium of ſalt of tartar, and the powder, at the bottom, ſalt-petre.

On adding freſh quantities of ſalt of tartar, new precipitations were afterwards formed, and, in fine, all the ſalt-petre which had been diſſolved was ſeparated. The ſalt petre being examined, by all trials proved true ſalt-petre, as pure and unmixed as when put in; and the liquor being evaporated, the ſalt of tartar was found equally pure. Salt of tartar tried afterwards in the ſame manner with ſolutions of other ſalts, with which it does not raiſe any fermentation, was found to have the ſame effect, precipitating all equally out of the ſolution.

In the common precipitations of ſalts, ſuch as alum and ſugar of lead, by means of an alkali, the alkali ſeizes upon the acid of thoſe ſalts, and by that means effects the thing, and therefore itſelf becomes changed into another ſalt, and the precipitate, robbed of that acid, is no longer the ſalt it was, but merely its baſe: but here the ſalts, both alkali and neutral, remain the ſame they were before both pure and unmixed, and the whole proceſs ſeems only one of them taking the place of the other.

The ſalts which are capable of ſucceſſive ſolutions in the ſame water, and of remaining ſuſpended together in it, muſt be all of the neutral kind; that is, they muſt be ſalts compoſed of acids, engaged in ſuch manner in the pores of their baſes, as to fill the whole, and leave no void ſpaces for the penetration of other acids. But this is by no means the caſe with ſalt of tartar, which, being wholly ſpunge-like in its ſtructure, readily admits all ſorts of acids, and ferments with them: and therefore is very capable of diveſting other ſalts of that, on the preſence of which their natural ſtate, as ſalts of a particular kind, depends.

Every alkali ſalt is, as it were, an eſſential ſalt, in part decompounded; that is, it is the earthy part of ſuch ſalt, the acid parts of which have been driven off by fire, and when there is only ſo much left, as may give the whole a ſaline form; for, if all the acids were to be driven off, the remainder would not be an alkali, nor yet a ſalt, but a mere ſimple earth; as is the caſe in the caput mortuum of ſpirit of nitre diſtilled by a retort, the reſiduum from this diſtillation being a mere dead earth, indiſſoluble in water, and altogether different from the fixed alkali produced by burning the ſame nitre with charcoal. What proves, alſo, that theſe alkalies are only the matrix of the compound ſalts diveſted of their acids, is, that if ſpirit of nitre be poured upon the alkali ſalt of nitre made with charcoal, true nitre is regenerated. *Mem. Acad. Par.* 1724.

SOLUTION, in algebra and geometry, is the anſwering a queſtion, or the reſolving any problem propoſed. See ALGEBRA and GEOMETRY.

SOLUTION *of Continuity*, in ſurgery, is the ſeparation of the natural coheſion of the ſolid parts of the body, by a wound.

SOLUTIVE, an appellation given to laxative and looſening medicines.

SOMNAMBULI, in medicine, perſons who walk in their ſleep, otherwiſe called noctambuli. See the article NOCTAMBULI.

SOMNIFEROUS, or SOPORIFEROUS. See the article SOPORIFEROUS.

SON, *Filius*, an appellation given to a male child, conſidered in the relation he bears to his parents.

SONATA, in muſic, a piece or compoſition wholly performed with inſtruments; and which is, with regard to inſtruments, what the cantata is with reſpect to voices.

SONG, in poetry, a little compoſition conſiſting of ſimple, eaſy, natural verſes, ſet to a tune, in order to be ſung.

SONG, in muſic, is applied, in general, to any ſingle piece of muſic, whether contrived for a voice or inſtruments.

SONNA, a book of Mahometan traditions, wherein all the orthodox Muſſulmen are required to believe.

SONNET, *Sonetto*, in poetry, a kind of compoſition properly contained in fourteen verſes, viz. two ſtanzas or meaſures of four verſes each, and two of three; the eight firſt verſes being all in two rhymes.

The ſonnet is of Italian origin, and Petrarch is allowed to be the father of it: it is held the moſt difficult and artful of all poetical compoſitions, as requiring the utmoſt accuracy and exactneſs. It is to end with ſome pretty ingenious thought: the cloſe muſt be particularly beautiful, or the ſonnet is naught.

SONNITES, among the Mahometans, an appellation given to the orthodox Muſſulmen, or true believers; in oppoſition to the ſeveral heretical ſects, particularly the Schiites, or followers of Ali.

The Sonnites are ſo called from their believing in the Sonna, or book of Mahometan traditions; which the Schiites reject as apocryphal. The Turks aſſume the name of Sonnites, in oppoſition to the Perſians, who are Schiites. The former think it unlawful to detain as ſlaves any who are Sonnites, though taken in war: if any ſuch are rebels, they muſt either be puniſhed with death, or releaſed. But this law is not obſerved by the Tartars, though they are Mahometans of the ſame ſect with the Turks.

SOOT, *Fuligo*, a volatile matter, ariſing from wood, and other fuel, along with the ſmoke; or rather, it is the ſmoke itſelf, fixed and gathered on the ſides of the chimney.

Wood-ſoot is of a ſhining black colour, a diſagreeable ſmell, and an acrid, bitter, and nauſeous taſte; its chief uſe, for medicinal purpoſes, being in hyſterical caſes, in which it is ſometimes exhibited in conjunction with the fetid gums.

The volatile ſalt and ſpirit of ſoot are, when ſufficiently purified, not different in quality from thoſe of animal ſubſtances; though ſome prefer them in nervous complaints, and particularly in epileptic caſes. The tincture of ſoot is made thus: take of wood ſoot, two ounces; of aſafœtida, one ounce; and proof ſpirit, two pints: digeſt and ſtrain. It is good not only in hyſterical caſes, but alſo in epilepſies, and other nervous diſorders.

Soot makes an excellent manure for cold lands that have been over-run with moſs; but the ſoot of ſea-coals is better for this purpoſe than that of wood. The dyers alſo make a conſiderable uſe of ſoot, for a dun colour.

SOPHI, or SOFI, a title given to the emperor of Perſia; importing as much as wiſe, ſage, or philoſopher. There is no prince in the world whoſe authority is more abſolute than that of the ſophi of Perſia.

SOPHISM, *σοφισμα*, in logic, &c. an argument which carries much of the appearance of truth, and yet leads into error.

There is ſome need of a particular deſcription of theſe fallacious arguments, that we may with more eaſe and readineſs detect and ſolve them:

1. The firſt ſort of ſophiſm is called *ignoratio elenchi*, or a miſtake of the queſtion. 2. The next ſophiſm is called *petitio principii*, or a ſuppoſition of what is not granted. 3. That ſort of fallacy which is called a circle, is very near a-kin to the *petitio principii*. 4. The next ſort of ſophiſm is called *non cauſa pro cauſa*, or the aſſignation of a falſe cauſe. 5. The next is called *fallacia accidentis*, or a ſophiſm, wherein we pronounce concerning the nature and eſſential properties of any ſubject, according to ſomething which is merely accidental to it. 6. The next ſophiſm borders upon the former, and that is when we argue from that which is true, abſolutely, ſimply, and abſtracted from all circumſtances; this is called, in the ſchools, a ſophiſm *a dicto ſecundum quid ad dictum ſimpliciter*. This ſort of ſophiſm has alſo its reverſe; as, when we argue from that which is true, ſimply, and abſolutely, to prove the ſame thing true in all particular circumſtances whatever. 7. The ſophiſms of compoſition and diviſion come next to be mentioned. The ſophiſm of compoſition is, when we infer any thing concerning ideas in a compound ſenſe, which is only true in a divided ſenſe. The ſophiſm of diviſion is, when we infer the ſame thing concerning

cerning ideas in a divided ſenſe, which is only true in a compounded one. This ſort of ſophiſm is committed when the word *all* is taken in a collective and diſtributive ſenſe, without a due diſtinction. It is the ſame fallacy, when the univerſal word *all*, or *no*, refers to ſpecies in one propoſition, and to the individuals in another. 8. The laſt ſort of ſophiſms ariſes from our abuſe of the ambiguity of words, which is the largeſt and moſt extenſive kind of fallacy; and, indeed, ſeveral of the former fallacies might be reduced to this head. When the words or phraſes are plainly equivocal, they are called ſophiſms of equivocation. This ſophiſm, as well as the foregoing, and all of the like nature, are ſolved by ſhewing the different ſenſes of the words, terms, or phraſes.

But, where ſuch groſs equivocations and ambiguities appear in arguments, there is little danger in impoſing on ourſelves or others; the greateſt danger, and what we are perpetually expoſed to, in reaſoning, is, where the two ſenſes or ſignifications of one term are near a-kin, and not plainly diſtinguiſhed; and yet are ſufficiently different in their ſenſe to lead us into great miſtakes, if we are not watchful. And, indeed, the greateſt part of controverſies, in the ſacred or civil life, ariſe from the different ſenſes that are put upon words, and the different ideas conveyed by them.

There is, after all theſe, another ſort of ſophiſm, which is wont to be called an imperfect enumeration or a falſe induction, when, from a few experiments or obſervations, men infer general theorems and univerſal propoſitions.

SOPHIST, a perſon who frames ſophiſms; that is, uſes ſubtle arguments, with intent to deceive thoſe he would perſuade or convince.

The word is framed from the Greek, σοφιστης, an impoſtor, or deceiver.

SOPHISTICATION is the adulterating any thing with what is not good.

This practice unhappily obtains too much among chemiſts, and others, who make up medicines for ſale; and, in many caſes, the cheat is carried on ſo artfully, as to prevent a diſcovery, even among perſons of the moſt diſcerning faculties.

SOPORIFICS, medicines which have the faculty of procuring ſleep.

The word is formed from the Latin, *Sopor*, ſleep.

SORBON, or SORBONNE, the houſe or college of the faculty of theology at Paris; becauſe the aſſemblies of the whole body are held in the houſe of the Sorbon.

SORITES, in rhetoric, a kind of argument, wherein a number of proportions are gradually and minutely laid together, and ſomething inferred from the whole.

The word is formed from the Greek, σωρος, an heap.

SORRANCE-WATER, a name given by our farmers to a ſolution of vitriol and ſome other ingredients in vinegar, a medicine much eſteemed in many of the diſeaſes of horſes: it is prepared in the following manner:

Take Roman vitriol and roach alum, of each an ounce and half, verdigreaſe an ounce, copperas two ounces: reduce all theſe to powder together, and put them into a two-quart bottle, into which pour a quart of the ſtrongeſt and beſt wine-vinegar; this is to be ſet in balneo mariæ. The ſhort way of doing which by the farrier is this: he puts a whiſp of hay into the bottom of a kettle, and then tying ſome pieces of lead or iron about the neck of the bottle, to make it heavy enough to ſink in water, it is ſet upon the hay ſo as to ſtand very upright; then three notches are cut length-wiſe in the cork to give paſſage to ſome of the vapours when the bottle is heated, that it may not burſt. When every thing is thus prepared, ſo much cold water is to be put into the kettle, that the neck of the bottle may ſtand two or three inches above it; the kettle is then to be ſet over the fire, and the water is to be made to boil, and kept boiling about half an hour, the bottle being at times taken out, and thoroughly ſhaken. When the ſalts are thus thoroughly diſſolved in the vinegar, the whole is to be kept for uſe.

The method in which they uſe it is this: take an earthen pan, which will hold about twelve quarts; let this be filled with urine that has been made by ſound, healthy, and young perſons; the ſtaler the urine is, the better it is for uſe, and indeed it ought always to ſtand, at leaſt, three weeks before it is uſed. It is proper for the farrier, therefore, always to keep a quantity of this ready, and, when the water is to be uſed, half a pint of it is to be mixed with a quart of the urine, or if it be required ſtronger, more of the water is to be added: theſe are to be thoroughly mixed together, and the legs, or other affected part of the horſe, bathed with it with ſoft rags twice a day.

The virtues of this water are highly extolled; it is ſaid to cure the glanders in two or three times dreſſing; it is alſo a ſovereign remedy for the mange, either dry or wet, and for the rat-tails, ſcratches, gourded or ſwelled legs and heels; and it alſo cures horſes, when the greaſe is fallen into their heels, as the farriers expreſs it. The farcy is alſo ſaid to be often cured by a long continuance in the uſe of it, purging the horſe two or three times, at different diſtances of time, during the time of his being under cure by the water. They alſo find it a good cleanſer and healer of foul ulcers, and that it prevents the breeding of proud fleſh and worms in wounds, and drives away a flux of humours that were falling upon any part. They uſe it alſo in clefts and cracks of the heels, and in wind-galls, eſpecially in the prevention of the laſt by its repellent qualities. The green water alone is an excellent remedy for fiſtulas, cankers, and the galled backs of horſes; diſpoſing ſuch ſerrances, as they are called, not to feſter, rot, and grow worſe, as all greaſy and oily medicines do, but cleanſing them, and laying the way to a very ſound and ſtanding cure.

SOVEREIGN, ſupreme; the chief and higheſt being, the Almighty; a term, in ſtrictneſs, only applicable to God.

SOVEREIGN, with regard to ſubjects, is applied to kings, and princes, who are ſupreme and independent, and whoſe authority is bounded only by the laws of God, of nature, and the fundamental laws of the ſtate.

SOUL, *Anima*, a ſpirit adapted to an organiſed body.

Many of the philoſophers allow of two and ſome of three kinds of ſouls, viz. a rational ſoul, which they hold to be divine and infuſed by the breath of God. Irrational, or ſenſitive ſoul, which man has in common with brutes, and which is formed out of the elements.

The philoſophers are not agreed, as to the manner wherein the ſoul reſides in the body. Some hold it equally diffuſed throughout every part thereof. Others ſay it influences and acts on every part of the body, though it has its principal reſidence in ſome particular part, called the ſenſory. This principal part Des Cartes maintains, is the pineal gland of the brain, where all the nerves terminate, &c.

Borri, a Milaneſe phyſician, in a letter to Bartholine, *De Ortu Cerebri & Uſu medico*, aſſerts, that in the brain is found a certain very ſubtile fragrant juice, which is the principal ſeat or reſidence of the reaſonable ſoul; and adds, that the ſubtility and fineneſs of the ſoul depends on the temperature of this liquor, rather than on the ſtructure of the brain, to which it is uſually aſcribed. this liquor, we conceive, muſt be the ſame with what is uſually called the nervous juice, or animal ſpirits; the conſtitution of which is, doubtleſs, of great importance, with regard to the faculties of the ſoul.

Mr. Locke diſtinguiſhes two principal faculties or powers of the rational or human ſoul, viz. perception and willing.

To theſe, other philoſophers add others, as ſenſation, liberty, memory, imagination, and habit.

The myſtic divines diſtinguiſh two principal parts in the ſoul; the ſuperior part, which comprehends the underſtanding and the will; and the inferior part, which comprehends imagination and ſenſation. Thus, ſay they, Jeſus Chriſt was happy on the croſs in his upper part, and ſuffered in his lower part. The lower part did not communicate to the upper either its troubles, or its failings; nor the upper to the lower its peace or beatitude. From this diſtinction, the Quietiſts take in hand to maintain, that whatever paſſes contrary to good morals, in the lower part of the ſoul, is not contrary to the purity of the

upper part, inaſmuch as the will has no ſhare therein.

As to the ſoul of brutes, the Carteſians, and ſome others, deny its exiſtence, in the common ſenſe of the word ſoul; that is, they ſtrip it of all the properties or faculties of the human ſoul: and the Peripatetics, on the contrary, inveſt it with the greateſt part of them.

In man, a particular agitation of the fibres of the brain is accompanied with a ſenſation of heat; and a certain flux of animal ſpirits towards the heart, and viſcera, is followed by love or hatred.

Now, the Peripatetics maintain, that brutes feel the ſame heat, and the ſame paſſions, on the ſame occaſions: that they have the ſame averſion for what incommodes them, and, in the general, are capable of all the paſſions and all the ſenſations we feel.

The Carteſians deny they have any perceptions or notices at all; that they feel any pain or pleaſure; or love or hate any thing. The ground of their opinion is, that they allow of nothing in brutes, but what is material, and that they deny ſenſations and paſſions to be any properties of matter. Some of the Peripatetics, on the other hand, maintain matter, when ſubtiliſed, framed, ranged, and moved in a certain manner, to be capable of ſenſation and paſſion; that beaſts may feel and perceive, by means of the animal ſpirits, which are matter thus modified; and that the human ſoul itſelf only becomes capable of ſenſation and paſſion, by means of the ſame animal ſpirits.

But we muſt own it very difficult to reconcile the idea we have of matter with what we have of thought; to conceive that matter figured in any manner, whether in a ſquare, a ſphere, or an oval, ſhould be pleaſure, pain, heat, colour, or ſmell; or to conceive that matter, however agitated, whether in a circle, a ſpiral, parabola or ellipſis, ſhould be love, hatred, or joy,—ſurpaſſes our endeavours.

The maintainers of the contrary opinion urge that appearance of ſenſe, of fear, caution, love for their young, admirable ſagacity, both for their own preſervation and that of their ſpecies, viſible through the whole brute creation. And it is true, all the actions of beaſts plainly expreſs an underſtanding; for every thing that is regular, expreſſes it; even a machine or watch expreſſes it: and a plant much more, the radicle of the ſeed turning downwards, and the ſtem upwards, whatever ſituation the ſeed is ſown in: the young plant, knitting from ſpace to ſpace, to ſtrengthen it; its putting forth prickles, &c. to defend it, &c. mark a great underſtanding. All the motions of plants and brutes plainly diſcover an intelligence; but the intelligence does not reſide in the matter thereof: it is as diſtinct from the beaſt or plant, as that which ranged the wheels of the watch, is diſtinct from the watch itſelf.

For, in effect, this intelligence appears infinitely great, infinitely wiſe, infinitely powerful; and the ſame which formed us in our mother's womb, which gave us our growth, &c. Thus, in brutes, there is not either underſtanding or ſoul, in the ſenſe we generally uſe the word: they eat without pleaſure, cry without pain, grow without knowing it. They fear nothing; know nothing; and if they act in ſuch manner as ſhews underſtanding, it is becauſe God, having made them, to preſerve them, has formed their bodies ſo as to avoid whatever might hurt them, mechanically.

Otherwiſe it might be ſaid, that there is more underſtanding in the vileſt inſect, nay, in the ſmalleſt grain, than in the moſt knowing of men; for it is evident, either of them contains more parts, and produces more regular motions and actions, than we are capable of underſtanding. Thus does the great F. Malebranche argue againſt the ſouls of brutes.

SOUND, *Sonus*, a perception of the ſoul communicated by means of the ear; or the effect of a colliſion of bodies, and a tremulous motion conſequent thereon, communicated thence to the circumambient fluid, and propagated through it to the organ of hearing.

We know by the experiment of the bell in the exhauſted receiver, that ſound has a neceſſary dependence on the air; and if we reflect on the nature of the particles of a ſonorous body, and thoſe of air, we ſhall find that ſound is nothing but the propagation of the tremors, and the vibrations of the former impreſſed on the latter, to the tympanum or drum of the ear, by the action of whoſe membrane they are communicated to the internal cavities of the ear, where the auditory nerve receives the impreſſion, and excites the ſenſation, in the common ſenſory, in the brain.

For the parts of a ſonorous body, being put in motion by percuſſion, vibrate forwards and backwards, through very ſmall ſpaces, by their elaſtic quality. In this action, they affect the particles of air contiguous to them, and compel them, upon the firſt impulſe, to move forwards alſo; and theſe propel the next, and ſo on to a very conſiderable diſtance, according to the intenſity of the percuſſive force. By this means, the particles of air are compreſſed nearer together, than in their natural ſtate.

But when the particles of the ſonorous body make the ſecond part of the vibration, by returning back again, the particles of air, alſo, by their repulſive power, repel each other toward their proper places, and thus again expand themſelves.

Now, ſince motion, once generated in elaſtic bodies, continues ſome time before it can be deſtroyed by the reſiſtance and counter-action of contiguous bodies, it follows, that the particles of the ſonorous body, and, conſequently, thoſe of the adjacent air, have, for ſome time, a reciprocal vibratory motion, by going forwards and backwards, through very ſmall ſpaces, in indefinitely ſmall particles of time; which motion gradually decreaſes, till it be totally deſtroyed.

Let A B C (plate CXXII. *fig.* 1.) be an elaſtic ſtring, or chord, fixed in the points A and C, and drawn out of its natural right lined ſituation A B C.

Such a chord, in its ſtate of tenſion, will, when let go, return, by its natural reſort, not only to its natural ſituation A D C, but with the motion it there has will go on to E, ſo that D E is nearly equal to B D; and from thence it will return again nearly to B, which motion from B towards E, and from E towards B, will be reciprocated a great number of times before the chord will come to a ſtate of reſt; and each motion through the ſpace B E is called the vibration of the chord.

When the chord begins its motion at firſt from B, it ſtrikes the particles of air contiguous to it in B, and that will, by its approach towards the next, affect it by means of the repulſive power, which keeps them all at equal diſtances from each other, and ſo on through ſuch a number of particles as can receive the motion, whilſt the ſtring moves from B to D. Let A, B, C, D, E, F, G, (*fig.* 2.) repreſent ſuch a ſeries of particles of air at an equal diſtance, and the firſt particle A, contiguous to the middle joint B, of ſuch a ſtring, and agitated by it in its motion.

The ſtring beginning to move, all the particles A, B, C, will begin to move forwards alſo; and, ſince this motion is propagated in time, let E be the remoteſt particle moved, while the chord is moving from B to D, during which time the chord is going from B to D; therefore the diſtance A B will be leſs in B C, and this leſs than C D, and that leſs than D E, and the diſtance E F will begin to be leſſened, when the ſtring is arrived at the ſite A B C, and the particles A, B, C, D, E, F, &c. will have the arrangement repreſented in the ſecond line. But now the chord, having acquired the ſituation A D C, will be no farther accelerated, but on the contrary retarded, as it will now go on from D to E; the effect of which, upon the particles of air before it, will be as follows: they will all go on forwards till the chord comes to E, and the particle A to its ſituation in the third line; but ſince the force upon A begins to abate, as the ſtring begins to move from D, the elaſtic force now between A and B will, by acting both ways, continue to accelerate the motion of B, and retard that of A. Thus the diſtance B C will ſtill diminiſh, till B comes to lie equidiſtant between A and C, and C will be accelerated till it be equidiſtant between B and D, and ſo on. So that, as the acceleration is continued forwards, the diſtances will diminiſh towards F; and, by the time the chord is arrived at E, the particles E E will be at their

neareſt diſtance. And, ſince the motion of A is continually retarded, it will loſe what before it had gained in the ſame time, and will therefore now be at the ſame diſtance from B, as at firſt nearly. So that the particle from A to G will have the ſituations as repreſented in the third line.

The chord now returning from E to D gives liberty to the repulſive power between A and B to ſeparate them to a greater diſtance than in their natural ſtate, and which they at preſent have. By this means all the other intervals B C, C D, D E, E F, will increaſe, and become ſucceſſively greater than the natural diſtance; but that exceſs will be leſſer in each, till you come to F G, which will be equal to the natural diſtance at preſent between A and B. The motion at the ſame time continuing in all the particles from H to N, they will all move forwards, and the preſent contracted interval between H and I will ſucceed between all the reſt, till it arrives at the particle N, when the interval M N will be the ſame as at preſent is M T. And thoſe particles beyond N to S will, by the preceding ones, be put into the ſame reſpective diſtances, but in an inverſe order, as thoſe have between G and N. And the whole ſeries, now the ſtring is at D, will have the intervals of the particles reſembling thoſe in the fourth line.

The chord not ſtopping at the ſituation A C D, but going on to A B C, with a retarded motion, the velocity of the contiguous particle A will alſo be retarded, and becomes leſs than that of B; upon which, the diſtance between them will be leſſened, and the more ſo, as the ſtring approaches to B. Hence all the intervals, now dilated beyond their natural ſtate, will, by degrees, contract; but gradually ſlower, till you come to T, where the preſent largeſt interval between A and B will be found between F and G, and that between A and B will have acquired its natural extent, when the chord is arrived at B. Then, likewiſe, the particles from G to N, will acquire the ſame ſituation as thoſe now have between A and G; and from N to S, the ſame as now is ſeen between G and N; and from S forwards the ſame as is now before the particle N, the point S being now the middle point of condenſation; all which is clearly ſeen in the fifth line of the figure. Thus the condenſation which begins at A, by the firſt parts of the vibration, was propagated to G by the ſecond, from thence to N by the third, and, laſtly, to S by the fourth part of the whole motion of the ſtring, in going and returning; and this extent of air, thus agitated by the chord in going and returning, is called by Sir Iſaac Newton a wave, or pulſe of air. In which wave the particles from A to N are in a dilated ſtate, and from N to X in a contracted or condenſed ſtate; which two parts of the wave anſwer to the concave and convex, or low and high part of a watery wave.

As the chord goes on to make another vibration, it will not only continue to agitate the air at preſent in motion, but will ſpread the pulſation of the air as much farther, and by the ſame degrees as before; and the like will happen after a very complete vibration of the ſtring. Thus the air being a fluid body, and the impreſſion made on any one part affecting all the particles alike around it, it is plain thoſe pulſes will be propagated in every direction all around in concentric aerial ſhells, or ſpherical waves of air.

That the motion of the pulſes in an elaſtic medium is analogous to that of the waves generated in the ſurface of ſtagnant water, is evident, when we conſider that the condenſation of the parts of the elaſtic medium is in lieu of the elevation of the water; the elaſtic force effects the ſame in the medium, as gravity does in the water, and the denſeſt part of the pulſes correſponds to the higheſt part of the waves.

Let A B C (*fig.* 3.) repreſent the ſonorous body; by the tremulous motion of its parts, it will agitate the air contiguous to every point, as A, where it will be condenſed to a certain ſmall diſtance, and make a pulſe or wave of air, in the manner as has been already ſhewn. The firſt wave or pulſe will, by its elaſtic power in expanding itſelf, produce a ſecond, that a third, and ſo on till the impreſſed motion be diffuſed through too large a quantity of air, to be any longer ſenſible.

The quantity of motion, produced by each tremor of the ſonorous body, being communicated ſucceſſively to large portions of air, the part thereof which each particle will acquire will conſtantly decreaſe. This decrement of the motion will be as the increment of the number of particles, which is as the ſuperficies of the ſpherical ſhell; and ſince all ſuperficies are as the ſquares of their diameters, or ſemi-diameters, therefore the force in the particles of the wave or ſhell at D is to that in the particles of the ſhell at T as A F^2 to A D^2, that is, the force of ſound decreaſes as the ſquares of the diſtances increaſe.

It is plain the diſtance to which ſounds may be heard, will be proportional to the magnitude or intenſity of the ſtroke made on the tremulous body emitting the ſound; for, the greater that ſtroke is, the greater will be the agitation of the parts of the ſonorous body, and, of courſe, the greater will be the force with which they will ſtrike the particles of air. Laſtly, the greater the force is upon the air, the more cloſely will it be condenſed and expanded; hence the greater will be the ſtroke at any given diſtance on the drum of the ear, and, conſequently, the greater will be the diſtance at which the agitation of the air will be ſenſible.

The experiments are numerous by which it has been found, that ſound is audible to the diſtance of 50, 60, or 80 miles, but Dr. Hearne, phyſician to the king of Sweden, tells us, that at the bombardment of Holmia, in the year 1658, the ſound was heard 30 Swediſh miles, which make 180 of ours. And in the fight between England and Holland, in the year 1672, the noiſe of the guns was heard even in Wales, which cannot be leſs than 200 miles.

Since the atmoſphere conſiſts not of pure air, but has a mixture of vapours of different elaſticity and tone, theſe vapours will not participate of the motion of pure air, by which ſound is propagated; in like manner, as an elaſtic ſtring ſtruck will not move another very near it, unleſs it be under the ſame degree of tenſion, and of the ſame tone. Therefore, the quantity of air, producing ſound, muſt be diminiſhed in proportion to the quantity of vapour in a given ſpace; in which Sir Iſaac Newton ſuppoſes the air is to the vapour as ten to one. Whence the air and vapour together, in a given ſpace, are to the pure air as eleven to ten.

But the velocity of the pulſes will increaſe in the ſubduplicate ratio of the diminiſhed quantity of matter, that is, in the ſubduplicate ratio of eleven to ten, or in the entire ratio of twenty-one to twenty; therefore, if we ſay, as 20 : 21 : 1088 : 1142 : whence the real velocity of ſound, thus inveſtigated, from the nature of elaſtic air, by our great author, is at length found to be at the rate of 1142 feet per ſecond.

The truth and accuracy of this noble theory have been ſufficiently confirmed by experiments, particularly thoſe made by the late Rev. Dr. Derham, of which we ſhall give ſome account, but will firſt lay before the reader a view of the different eſtimates made of the velocity of ſound by ſeveral eminent philoſophers, as in the table following:

	Feet per ſecond
The Hon. Mr. Roberts,	1300
The Hon. Mr. Boyle,	1200
Mr. Walker,	1338
Merſennus,	1474
The academy at Florence,	1148
The royal academy at Paris,	1172
Sir Iſaac Newton, Flamſteed, Halley, and Derham,	1142

As no man ever had a better opportunity, ſo none could improve it with greater diligence, aſſiduity, and accuracy, in determining and ſettling the various phœnomena of ſounds, then the ſo often celebrated author laſt mentioned. He proved by experiments made with the ſtrokes of a hammer, and the exploſion of a gun at the ſame time, at the diſtance of a mile, that the velocity of ſounds produced from different bodies was the ſame, or came to his ear in the ſame time.

That

That the motion of ſound was equable and uniform, or that it paſſed through ſpaces proportional to the times, he found by various experiments made by the exploſion of guns, at different diſtances, as appears by the following table which he has given us, where the firſt column ſhews the places at which the guns were fired; the ſecond the number of vibrations of an half-ſecond pendulum; the third the diſtance of places in miles and decimal parts, as meaſured by trigonometry; the fourth the diſtances meaſured by the velocity of ſounds, admitting it to be at the rate of one mile every 9 ¼ half-ſeconds.

At Hornchurch,	9	0,9875	
North Okenden church,	18½	2,004	2,000
Upminſter mill,	22½ or 23	2,4	2,4 or 2,48
Little Warley church,	27½	3,0	2,97
Rainham church,	33¼	3,58	3,59
Alvel mill,	33	3,58	3,57
Dagenham mill,	35	3,85	3,78
Southweall church,	45	4,59	4,86
Eaſt Thornden church,	46½	5,09	5,03
Barking church,	70½	7,7	7,62
Guns at Blackheath,	116	12,5	12,55

The great exactneſs of meaſuring diſtances by ſounds appears from the above table, as well as the equability of the motion; but, to render this matter ſtill more certain and indiſputable, the doctor took a journey to Foulneſs-ſands, on the coaſt of Eſſex, which form a ſmooth large plain for miles. On this plain he meaſured ſix miles in a right line, and, cauſing a gun to be fired at the end of each mile, he found that his former obſervations were very juſt and true, and that ſound paſſed the firſt mile in 9 ¼ half-ſeconds, two miles in 18 ½, three miles in 27 ¾, and ſo on to the end of the ſix.

The Academia del Cimento made experiments of this ſort, from which they concluded, that the velocity of ſounds was ſo far equable, as not to be accelerated or retarded by conſpiring or adverſe winds; but in this they led themſelves and many others into a very great miſtake, which was owing to their firing of guns at too near a diſtance; for in great diſtances the difference is ſenſible.

SOUND, in muſic, denotes a quality of the ſeveral agitations of the air, conſidered ſo that their diſpoſition, meaſure, &c. may produce muſic or harmony.

SOUND, in geography, implies a ſtreight, or inlet of the ſea, between two head-lands.

The famous ſtreight which joins the German ocean to the Baltic, is called, by way of eminence, the Sound.

SOUND-BOARD, the principal part of an organ, and that which makes the whole machine play.

The ſound-board, or ſummer, is a reſervoir into which the wind, drawn in by the bellows, is conducted by a port vent, and hence diſtributed into the pipes placed over the holes of the upper part. The wind enters them by valves, which open by preſſing upon the ſtops or keys, after drawing the regiſters which prevent the air from going into any of the other pipes, but thoſe it is required in.

SOUNDING, in navigation, the act of trying the depth of the water, and the quality of the bottom, by a line and plummet, or other artifice.

The ſounding-line is the thickeſt and ſhorteſt, as not exceeding twenty fathoms in length; and marked at two, three, and four fathoms, with a piece of black leather between the ſtrands; and at five with a piece of white leather. The ſounding line may be uſed when the ſhip is under ſail, which the deep ſea-line cannot. The plummet is uſually in the form of a nine-pin, and weighs eighteen pounds, the end of which is frequently greaſed, to know whether the ground is ſandy or rocky. Near banks, ſhores, &c. they ſound continually.

SOUR *Land*, in agriculture, a term uſed by the farmers to expreſs a cold, and ſomewhat wet clayey ſoil.

This muſt have its tilth according to its ſtate and condition, when they ſet about it. If it have a ſtrong ſwarth upon it, then they give it a fallow, by turning it up, when the ſun is in Cancer; this they call a ſcalding fallow, and eſteem it of great uſe, becauſe it kills the graſs roots, and makes the land fine; but, if it be light, and have but a thin ſwarth, they leave it for a cooler tillage, and plow it early in the year, when their clay is fallowed. Pigeon's dung and malt duſt are the moſt proper manures for this ſoil. The malt duſt is to be ſown with the winter corn, and plowed in with it, for then it lies warm at the roots of the corn all winter.

SOW, in the iron-works, the name of the block, or lump of metal, they work at once in the iron-furnace. The ſize of theſe ſows of iron is very different, even from the ſame workmen, and the ſame furnace. Theſe furnaces having ſandſtone for their hearths and ſides, up to the height of a yard, and the reſt being made of brick, the hearth, by the force of the fire, is continually growing wider; ſo that, if it at firſt contains as much metal as will make a ſow of ſix or ſeven hundred weight, at laſt it will contain as much as will make a ſow of two thouſand weight.

SOWING. One very great article, in ſowing to advantage, is to know exactly at what depth the ſeed may be planted, without danger of burying it. Seed is ſaid to be buried, when it is laid at a depth below what it is able to come up at. Different ſorts of ſeeds come up at different depths, ſome ſix inches, or more; and others will not bear to be buried at more than half an inch. The way to come at an accurate knowledge of the depth at which every ſeed will come up beſt from the ſowing, is by making gages in the following manner: ſaw off twelve ſticks of about three inches diameter, bore a hole in the end of each ſtick, and drive into each a taper peg; let the peg in the firſt ſtick be half an inch long, the next an inch, and ſo on, every peg being half an inch longer than the other, till the laſt is ſix inches long: then in that ſort of ground, in which you intend to plant, make a row of twenty holes with the half-inch gage, put therein twenty good ſeeds, cover them up, and then ſtick the gage at the end of that row. Proceed in the ſame manner with the eleven other gages, making the holes in the ſame row all with the ſame gage, and ſticking it at the end of the row: when the ſeeds begin to appear, it will be eaſy to ſee at what depth they come up beſt, by obſerving the moſt flouriſhing row, and taking up the gage at the end, and ſeeing what is its length.

By this means we not only know what is the depth in that ſort of ground, at which this ſort of ſeed will come up beſt, but alſo we are able to judge of the nature of the ſeed; for by obſerving how many of the twenty ſeeds that were ſown come up, and how many fail, it is eaſy to calculate how much bad ſeed there is among any given quantity, and to allow properly for it in the ſowing, that the field may be neither overſtocked with plants, nor too bare of them. The farmer often ſuſtains great loſſes by ſowing bad ſeed, or by burying good ſeed, and both might be effectually prevented, by making theſe eaſy trials. One caution is to be obſerved in this, that it is not proper to ſow the ſeeds of all plants at the greateſt depths at which they will come up, becauſe in wheat, and ſome other grain, a moiſt ground will rot the roots at this depth. Experience alone, added to theſe rules, can perfectly inſtruct the farmer in the certain way of ſucceeding; the nature of the land, the manner how it is laid, either flat or in ridges, and the ſeaſon of planting, muſt all be conſidered.

The quantity of ſeed is to be different alſo, according to the manner of the ſowing. The proper quantity to be drilled into an acre, is much leſs than muſt be ſown in the common way; not becauſe the hoeing will not maintain as many plants as the other way, for, on the contrary, it will maintain many more; but the difference is upon many other accounts, as that it is impoſſible to ſow it ſo evenly by hand as the drill will do. For let the hand ſpread it never ſo exactly, which yet is difficult enough to do with ſome ſeeds in windy weather, yet the unevenneſs of the ground will alter the ſituation of the ſeeds, the greateſt part of them rebounding in the holes, and the loweſt places, or elſe the harrows, in covering, drawing them down thither: ſo that theſe low places may have ten times too much ſeed, and the higheſt may have much too little, or even none of it: and this inequality leſſens in effect the quantity of the ſeed, becauſe fifty ſeeds, in the room of one, will not produce ſo much as

one will do; and where they are too thick, without being in theſe cluſters, they cannot well be nouriſhed, their roots not ſpreading to near their natural extent, for want of hoeing to open the earth, and give them way. In the common way of ſowing, ſome of the ſeeds are buried out of all hope of ever coming up again, and ſome others are left naked upon the ſurface, where they become the food of birds, and of vermin: as ſo many muſt, therefore, periſh in the common way of ſowing, and ſo few can be loſt in the way by drilling, there is plain reaſon why the ſeed, neceſſary to ſow any given quantity of ground, ſhould be much leſs for the drill-way, than for the other.

The farmers, in general, know nothing of the proper depth at which they ſhould ſow their ſeed, nor of the difference in quantity that is to be obſerved in different circumſtances; they allow the ſame quantity to an acre of rough ground, as they do to an acre of fine, and forget that what is too little for one, may yet be too much for the other; it is all mere chance-work, and they put their confidence in good ground, and a large quantity of dung to cover their errors.

The farmers in Wiltſhire allow more corn for the ſowing, than in any other part of England; they uſe ſometimes eight buſhels of barley to an acre, ſo that, if it produce four quarters for an acre, there is but four grains for one increaſe. This is ſown on land plowed once, and double dunged, the ſeed only harrowed into the hard and ſtale ground, ſo that it is very probable that not ſo much as two buſhels out of the eight take place, or come to any thing. Sometimes, in a very dry ſeaſon, an acre ſcarce produces four buſhels at the harveſt.

Inſtead of all this uncertainty and loſs in the common way, in drilling all the ſeed lies juſt at the ſame depth, not one grain of it being placed deeper or ſhallower than the reſt. As none of the ſeeds, therefore, can be loſt by being buried, or by being expoſed on the ſurface to vermin, no allowance is to be made for theſe accidents; all that is to be allowed for in the ſowing, is the miſchief that may happen from the worm, the froſt, or the like unavoidable accidents common to all ſeeds.

When a man has (by the uſe of the gages and the growth of the ſeeds planted in the rows marked by them) proved the goodneſs of the ſeed, and found the depth it is to be planted at, he is to calculate what number of ſeeds a buſhel, or any other weight or meaſure, contains; for one buſhel, or one pound of ſmall ſeed, may contain double the number of ſeeds of a buſhel, or a pound of large ſeed of the ſame ſpecies. This calculation is made by weighing an ounce, and then calculating the number of ſeeds this ounce is compoſed of; then weighing a buſhel, and multiplying the number of ſeeds in an ounce by the number of ounces in the buſhel, and the product will give the number of ſeeds in the buſhel with ſufficient exactneſs.

When this is known, the ſeeds are to be proportioned by the Rule of Three to the ſquare feet in an acre; or elſe it may be done, by dividing the ſeeds of the buſhel by the ſquare feet in an acre, and the quotient will give the number of ſeeds for every foot. Then the farmer is to conſider how near he intends to plant the rows, and whether ſingle, double, treble, or quadruple; for the more numerous the rows are, the more ſeed will be required. The narrow ſpaces between double, triple, or quadruple rows, ſuppoſe ſeven inches; the double having one, the treble two, and the quadruple three, are called partitions. The wide ſpace, ſuppoſe of five feet, between any two of theſe double, treble, or quadruple rows, is called an interval. Examine next what is the produce of one middle-ſized plant of the annual, but the produce of the beſt and largeſt of the perennial ſort, becauſe that, by hoeing, will be brought to its utmoſt perfection; proportion the ſeed of both to the reaſonable product, and, when it is worth while, adjuſt the plants to their competent number with the hand-hoe after they are up, and plant perennials generally in ſingle rows. Laſtly, plant ſome rows of the annual thicker than others, which will ſoon give experience, preferable to all the rules in the world, for the quantity of ſeed neceſſary for the drilling. The diſtances of the rows is one extremely material point in the obtaining a good crop; but as a much larger diſtance is to be allowed in theſe, than common practice has been uſed to, it is very difficult to perſuade the farmer to venture a trial at ſuch diſtances as he may have experience from. There is a method of planting the rows by the drill at very near diſtances, and in this work one horſe may draw a drill with eleven ſhares, making the rows at three inches and a half diſtance from each other, and at the ſame time ſowing in them three different ſorts of ſeeds, which do not mix, and theſe at different depths. Thus the barley-rows may be ſeven inches aſunder; and the barley four inches deep; a little more than three inches above that, in the ſame channels, clover-ſeed; and, between every two of theſe rows, a row of ſaintfoin ſeed covered half an inch deep.

Mr. Tull, who tried this method, obtained the firſt year a very good crop of barley; the next year, two crops of broad clover, where that was ſown; and where the hop-clover was ſown, a mixture of that and ſaintfoin, and every year afterwards a crop of ſaintfoin. But the ſame gentleman was afterwards ſo fully convinced of the folly of theſe, or any other mixed crops, and of ſowing with theſe narrow, that he never practiſed it afterwards.

Every row of vegetables, to be horſe-hoed, ought to have an empty ſpace, or interval of thirty inches, on one ſide of it at leaſt, and of near five feet in all ſorts of corn: this will ſeem a monſtrous allowance to thoſe who have not experienced the good effects of it, but all who have will readily come into the practice of it ever afterwards. The line of corn is called one row, though it be double, triple, or quadruple, becauſe, when four of theſe rows grow up in the ſpring, they unite, and ſeem to be all one row. Wide intervals are neceſſary for perfect horſe-hoeing, and the largeſt vegetables have generally the greateſt benefit by them, though ſmall plants may have conſiderable benefit from much narrower intervals than thoſe of five feet.

In hand-hoeing there is always leſs ſeed, fewer plants, and a greater crop, *cæteris paribus*, than in the common ſowing; yet, there the rows muſt be much nearer than in horſe-hoeing, becauſe, as the hand moves many times leſs earth than the horſe, the roots will be ſent out in a like ſmaller proportion; and if the ſpaces, or intervals, where the broad hoe only ſcratches a little of the ſurface, ſhould be wide, they would be ſo hard and ſtale underneath, that the roots of the perenial plants would be a great while in running through them, and the roots of annual plants would not be able to do it at all.

The advantage of the horſe-hoeing is principally owing to the depth to which it ſtirs the ground, and familiar inſtances have proved, that the ſtirring it to a like depth, by whatever inſtrument, is of the utmoſt advantage to whatever plants are ſet in the place.

A poor fellow in Wiltſhire was obſerved to have always his cabbages much larger and finer than his neighbours, though his ground was no better, and he could afford leſs dung; but the reaſon was, that inſtead of clearing away the weeds between them with a hand-hoe, he uſed to dig between them with a ſpade, which goes as deep as a horſe-hoe, and comes the neareſt anſwering its purpoſes of any inſtrument whatever. *Tull's Horſe-hoeing Huſbandry.*

SPA, a town in the biſhopric of Liege, in Germany, famous for its mineral waters. Thoſe of the Pouhon ſpring in Spa are preferred, by our chief phyſicians, to any others in or near the county of Liege.

The contents of this water, by means of which it is able to do ſuch great things in many chronical caſes, are underſtood by the following experiments and obſervations.

Firſt, when the Spa-water is carried to any diſtant place, though ever ſo well ſtopped down, they always, after a time, will precipitate a ſmall quantity of a yellow ochreous earth.

Secondly, if a ſingle grain of galls be put into an ounce of Spa-water, it tinges the whole with a beautiful purple; but, if the water be heated before the galls are put in, there will not be the leaſt change of colour produced in it.

Thirdly, mixed with milk, they do not coagulate it; but, when mixed with wine, they make a great ebulli-

tion, and throw up a large quantity of air-bubbles with a peculiarly pleaſing ſmell.

Fourthly, the waters drank at the ſpring cauſe a ſort of drunkenneſs, but it does not laſt above a quarter of an hour.

Fifthly, a ſmall phial, being filled up to a certain height with Spa-water, and afterwards exactly to the ſame height with pure diſtilled water, and weighed, when filled with each, in a nice balance, was found, when the Spa-water was in it, to weigh three ounces, four drachms, and forty grains: and with the other three ounces four drachms and forty-one grains; ſo that the Spa-water, notwithſtanding its mineral particles, is ſomewhat lighter than the pureſt common water.

Sixthly, and finally, a pint of the Spa-water evaporated over a very gentle fire, leaves behind only a grain and half of a white powder.

Hence, it appears, that the Spa-waters are the lighteſt and moſt ſubtile of all the mineral waters; and the ſmall quantity of earth, and large portion of ſubtile mineral ſpirit they contain, beſpeak their poſſeſſing the moſt exalted virtues of all the mineral waters.

One very remarkable virtue of this water is, that it greatly relieves in all diſorders of the kidnies, ureters, and bladder, whether occaſioned by ſtone, gravel, or ulcerations. It poſſeſſes, beſides, all the virtues of the other mineral waters, and is of the greateſt ſervice in edulcorating ſharp, and dividing viſcous humours, and removing all diſeaſes ariſing from theſe cauſes, by diſpoſing them to paſs off by the proper emunctories.

SPACE, *Spatium*, is defined by Mr. Locke, to be a ſimple idea which we attain both by our ſight and touch; the modes of which are diſtance, capacity, extenſion, duration, &c.

Space, conſidered barely in length, between two bodies, is the ſame idea which we have of diſtance. If it be conſidered in length, breadth, and thickneſs, it is properly called capacity; when conſidered between the extremities of matter which fills the capacity of ſpace, with ſomething ſolid, tangible, and moveable, it is then called extenſion; ſo that extenſion is an idea belonging to a body, but ſpace, it is plain, may be conceived without it. Each different diſtance is a different modification of ſpace, and each idea of any different ſpace is a ſimple mode of this idea: ſuch are an inch, foot, yard, &c. which are the ideas of certain ſtated lengths, which men ſettle in their minds for the uſe, and by the cuſtom of meaſuring. When theſe ideas are made familiar to mens thoughts, they can repeat them as often as they will, without joining to them the idea of body, and frame to themſelves the ideas of feet, yards, or fathoms, beyond the utmoſt bounds of all bodies, and by adding theſe ſtill one to another, enlarge their idea of ſpace as much as they pleaſe. From this power of repeating any idea of diſtance without ever coming to an end, we come by the idea of immenſity.

Another modification of ſpace is taken from the relation of the termination of the parts of extenſion, or circumſcribed ſpace, amongſt themſelves; and this is what we call figure. This, the touch diſcovers in ſenſible bodies, whoſe extremities come within our reach; and the eye takes, both from bodies and colours, whoſe boundaries are within its view; where obſerving how the extremities terminate, either in ſtraight lines, which meet at diſcernible angles; or in crooked ones, wherein no angles can be perceived; by conſidering theſe as they relate to one another in all parts of the extremities of any body or ſpace, it has that idea we call figure, which affords to the mind infinite variety.

Another mode belonging to this head is, that of place.

There is another mode of ſpace, the idea of which we get from the fleeting and perpetually periſhing parts of ſucceſſion, which we call duration.

Space is uſually divided into abſolute and relative. Abſolute ſpace is that conſidered in its own nature, without regard to any thing external, which always remains the ſame, and is infinite and immoveable.

Relative ſpace, is that moveable dimenſion, or meaſure of the former, which our ſenſes define by its poſitions to bodies within it, and this is the vulgar uſe for immoveable ſpace.

Relative ſpace in magnitude and figure, is always the ſame with abſolute; but it is not neceſſary it ſhould be ſo numerically; as if you ſuppoſe a ſhip to be, indeed, in abſolute reſt, then the places of all things within her will be the ſame, abſolutely and relatively, and nothing will change its place: but ſuppoſe the ſhip under ſail or in motion, and ſhe will continually paſs through new parts of abſolute ſpace; but all things on board, conſidered relatively in reſpect to the ſhip, may be, notwithſtanding, in the ſame places, or have the ſame ſituation and poſition in regard to one another.

Proper and abſolute motion is defined to be the application of a body to different parts of abſolute, that is, infinite and immoveable ſpace. The Carteſians, who maintain extenſion the eſſence of matter, aſſert, that the ſpace any body takes up is the ſame thing with the body itſelf; and that there is no ſuch thing as mere ſpace void of all matter in the univerſe.

SPACE, in geometry, denotes the area of any figure, or that which fills the interval or diſtance between the lines that terminate it.

SPACE, in mechanics, the line a moveable body, conſidered as a point, is conceived to deſcribe by its motion.

SPADE, an inſtrument for digging up the ground, the handle or ſhaft whereof is about three feet long; the head is all of iron; the upper part being flat for the workman to ſet his foot on, to force it into the ground; the length of the head is about a foot or fifteen inches, and the breadth ſix or eight.

SPAGIRIC ART, *Ars Spagirica*, a name given by authors to that ſpecies of chemiſtry which works on the metals, and is employed in the ſearch of the philoſopher's ſtone.

SPAHI'S, horſemen in the Ottoman army, chiefly raiſed in Aſia. The great ſtrength of the grand ſeignior's army conſiſts in the janizaries, who are the foot, and the ſpahi's, who are the horſe.

SPAIN, including Portugal, is a large peninſula of Europe, lying between 10° weſt and 3° eaſt longitude, and between 36° and 44° north latitude, being about ſeven hundred miles in length from eaſt to weſt, and about five hundred in breadth from north to ſouth: it is bounded by the bay of Biſcay, on the north; by the Pyrenean mountains, which ſeparate it from France, on the north-eaſt; by the Mediterranean-ſea, on the ſouth-eaſt; and by the Atlantic ocean, on the weſt. See PORTUGAL.

SPAN, a meaſure taken from the ſpace between the thumb's end and the tip of the little finger, when both are ſtretched out.

The ſpan is eſtimated at three hand's breadths, or nine inches.

SPAR, in natural hiſtory, a ſhining ſtony ſubſtance, generally, though improperly, ſuppoſed to be compounded of cryſtal, incorporated with ſome mineral, earthy, ſtony, or metallic matter; frequently found in caves and grotto's, and in the clifts of rocks, lead mines, &c.

Spar is naturally pellucid, and is found in almoſt an infinite variety of forms; in ſome of which it retains its tranſparency and purity, in others it is more or leſs debaſed by an admixture of earth, and grows, accordingly, leſs and leſs clear, till, from the marbly hue of ſome of the moderately debaſed kinds, it ſinks in ſome to a mere earthy appearance. The genuine and diſtinguiſhing characters of ſpar, in whatever form it occurs, are theſe; it will not produce fire when ſtruck againſt a ſteel, it ferments very briſkly with aqua fortis, and, when pure, is totally diſſolved by it, and is very readily calcined in a ſmall fire.

Spars are defined to be foſſils not inflammable, nor ſoluble in water. When pure, pellucid and colourleſs, and emulating the appearance of cryſtal, but wanting its diſtinguiſhing characters; compoſed of plane and equable plates, not flexile nor elaſtic; not giving fire with ſteel, readily calcining in a ſmall fire, and fermenting violently with acids, and wholly ſoluble in them.

The

The obſervation, that ſpar is continually formed at this time in caves and grottoes under ground, has given birth to many different conjectures, as to the origin of that ſubſtance.

We have accounts from Swiſſerland, and other places, that the ſnow, by long lying on the earth, and being ſubject to repeated freezing, is at length hardened into ſpar: this is much of the nature of that opinion of the ancients concerning cryſtal, that it was water frozen by ſevere colds to a ſort of ice, much harder than the common kind; both are equally erroneous and abſurd. But more rational conjectures, as to its origin, are, that it is produced either by effluvia alone, or by the joint force of effluvia iſſuing up from the depths of the earth, and mixing with water ouzing out of the rocks into their cracks and cavities, or by the ſame water or effluvia paſſing through beds of this ſparry matter contained in clay.

In the firſt place we are to obſerve, that ſpar is capable of being diſſolved either by water or vapour, and ſuſpended imperceptibly in either; and that, though it remains ſuſpended a long time, yet there are occaſions of its ſeparating itſelf from either of theſe vehicles; ſuch are long ſtanding ſtill and evaporation. What is called the growth and formation of ſpar, therefore, is properly perhaps only the change of place in this ſubſtance, and all that theſe agents, water and vapours, do, is only to waſh it out of the ſtrata of earth or ſtone, in which it lay in ſcattered particles, and bring it together into the cracks and crevices of ſtones, where it may again ſeparate itſelf, and become more pure and perfect.

The operation of nature, in this caſe, is very like that of art in the extracting of ſalts from the various bodies they are mixed with; and ſpar, in its two ſtates, when blended in the ſtrata of ſtone, &c. and when pure, and in form of cryſtals in the cracks, may be compared to alum, for inſtance, in its bed and when purified. The alum in the common ſtones, from which it is made, is not perceptible to the eye, but lies in ſcattered particles; water being added to this takes up the ſalt, and, when it has been managed by evaporation and reſt, yields it again purified and alone, and it forms ſuch cryſtals on the ſides of the veſſel, as the other does on the ſides of the fiſſures of ſtone, which are the veſſels where the water, out of which it was formed, was ſet to evaporate, and to reſt a proper time.

That ſome ſpars grow from vapours alone, is evident from the ſtalactitæ, or ſtony icicles, hanging down from the roofs of our caverns, which, though they grow downwards, yet have many times little plants of the ſame ſubſtance growing out of their ſides, and ſtanding upwards contrary to the growth of the other, and evidently formed of the matter ſeparated from the vapours in their aſcent, as the ſtalactitæ themſelves are from ſuch as have aſcended to the roof, and there been condenſed into water, and ſent down again in drops. Nor is the ſparry matter alone thus raiſed in vapour, for even the metals, and other bodies, as little likely as thoſe to be thus raiſed, yet are found to form ſtalactitæ.

The mundics, in general, though they never form regular ſtalactitæ, yet often are found adhering to the ſides of them, and the metals, particularly iron and lead, form regular ſtalactitæ; the iron ones very common, and very perfect; the lead leſs perfect, and more rare; and Dr. Brown gives us abundant inſtances of ſpars growing entirely from vapours in the baths of Buda in Hungary. *Phil. Tranſ.* N°. 129.

SPARADRAP, in pharmacy, &c. a ſort of cere-cloth, called alſo tela Gualteri, the form of which is directed as follows: take of the diapalma plaiſter, and diachylon with the gums, each one pound; ceruſs, half a pound; root of orris finely powdered, an ounce and a half. Mix theſe together, and whilſt they are in fuſion, dip them in ſoft worn-out linen rags, ſo that they may be covered with the plaiſter on each ſide; then take them out, ſpread them, and let them dry; and ſmooth the ſurfaces with a knife or ſpatula. The principal uſe of theſe is for iſſues.

SPARROW, *Paſſer*, in ornithology, a ſpecies of the fringilla.

The common ſparrow is the brown fringilla, with a black throat and brown temples. It is larger than the linnet, and the male is an erect and handſome bird; the head is large, the eyes ſmall, and the beak ſhort; the wings are ſhort, and the tail ſhort and forked.

The reed ſparrow, or the fringilla with a black head, brown at the ſides, and with a white ring round the neck, and a mottled black and white breaſt, is a very beautiful and ſingular bird, of the ſize of the common linnet; the head is ſmall and depreſſed, the beak ſhort and black, and the eyes hazel; and in moſt other particulars it correſponds with the common ſparrow.

SPARROW-HAWK, in ornithology, the yellow-legged falco with a white undulated breaſt, and a faſciated brown tail.

This bird is about the bigneſs of a pigeon, but conſiderably longer bodied, in proportion to its thickneſs; its wings, when expanded, meaſure twice the length of the body and tail; the tail is ſhort but very ſtrong, thick at the baſe, very ſharp at the point, and conſiderably hooked; the head is ſmall, ſomewhat flatted, and of a browniſh colour; the eyes are as it were ſunk in the head, and their iris is yellow and bright.

SPASM, *Spaſma*, or *Spaſmus*, in medicine, a convulſion.

A ſpaſm, according to Hoffman, may be univerſal or particular, ſalutary or morbous. An univerſal ſpaſm happens if the whole vaſcular genus, chiefly the heart and arteries, as alſo the fibres of the ſyſtem, are affected, and there is a preternatural conſtriction therein, whereby the ſyſtole and diaſtole are increaſed, and the progreſs of the blood accelerated; this conſtitutes a fever, whereof a frequent pulſe is the moſt certain ſign. The other kind of ſpaſms is particular, and affects only one part of the body, which it conſtringes, and intercepts the free progreſs of the blood, rendering it unequal, and ſending it in greater plenty to the other parts of the body. But particularly this ſpaſtic affection affects the nervous and membranous parts, ſuch as the ſtomach, and the whole volume of the inteſtines; whence proceed the hyſteric and hypochondriac paſſions. A ſpaſm is likewiſe preſent in hæmorrhages, congeſtions of the blood, and unequal flux of the fluid in all anxieties and ſuppreſſed excretions.

If a violent ſpaſm happens to affect the dura mater, an epilepſy or univerſal convulſion follows; and convulſive motions of the membranes and nerves have their origin from the medulla ſpinalis. A ſpaſm is ſalutary when it deſtroys the cauſe of the diſeaſe, by taking away the ſtagnation of the humours, correcting acid cauſtics, and promoting the excretion of the morbid matter; but it is very pernicious when it conſtringes the ſkin and all the excretory veſſels, detaining the morbous matter therein, and forcing it upon the vital parts.

In a ſpaſm of the lower jaw, when the patient can neither open his mouth nor eat; as when perſons are wounded, and ſomething foreign is lodged therein, or when the nerves are hurt, or when ſharp things, ſuch as vitriol, are applied to ſtop the blood; the cure muſt be performed according to the diverſity of the cauſes as particularly treated of in ſurgery; but when this happens ſpontaneouſly in infants, it is obſerved that they generally die, though the beſt nervous and antiſpaſmodic medicines be uſed.

In the cynic ſpaſm, or, as it is otherwiſe called, the Sardonian laughter, if it proceeds from poiſons, as it generally does, eſpecially hemlock or oenanthe, Heiſter directs that they be expelled immediately from the body by a vomit; then giving generous wines, warm with ginger or pepper, as was the practice of the ancients. If it happens from other cauſes, it muſt be treated with antiſpaſmodics and nervous medicines, both inwardly and outwardly, and chiefly with plaſter of betony and bayberries prepared with oil of amber, and applied to the temples, and behind the ears.

SPASMODIC, ſomething belonging to a ſpaſm or convulſion.

SPATHA, a word uſed by different authors in various ſenſes; among botaniſts it expreſſes that ſort of cup which conſiſts of a ſimple membrane growing from the ſtalk: this kind of cup is of various figures, often diphyllous, or divided into two parts; often ſimple; ſometimes more divided: it incloſes ſometimes a ſingle flower, ſometimes ſeveral flowers together, and theſe have

have often no perianthium; the ſpatha is of very different texture and conſiſtence in different plants.

Some authors, by this word, expreſs a rib; others, the chirurgical inſtrument called ſpatula; others, a ſort of inciſion-knife; and by others it is taken for a ſword, this laſt being, indeed, its proper ſignification, and all the reſt being only metaphorical applications of it to different things, which bear ſome reſemblance to a ſword.

SPATULA, or SPATHULA, an inſtrument uſed by ſurgeons and apothecaries. This inſtrument is made of different ſhapes, according to the various uſes of it.

SPAVIN, in the manege, a diſeaſe in horſes, being a ſwelling or ſtiffneſs uſually in the ham occaſioning a lameneſs. There are two kinds of ſpavins, viz. the ox-ſpavin, which is a callous tumour at the bottom of the ham on the inſide, hard as a bone, and very painful; while it is yet recent, ſome only halt with it at the firſt coming out of the ſtable: the other, which is the dry ſpavin, is more eaſily perceived by the horſe's raiſing one of his hind legs with a twitch higher than the other; but ſometimes it is found on both legs. This kind, which ſome alſo call ſtring-halt, frequently degenerates into the ox-ſpavin, for which there is no remedy but to apply the fire, and even this is not always ſucceſsful.

There are two other kinds of ſpavin which have their ſeat in the hoof, viz. the blood-ſpavin, being a ſoft tumour which grows through the horſe's hoof, and is uſually full of blood; the other is the bone-ſpavin, being a cruſty ſubſtance growing on the inſide of the hoof under the joint.

SPAYING, or SPADING, the operation of caſtrating the females of ſeveral kinds of animals, as ſows, bitches, &c. to prevent any further conception, and promote their fattening.

SPEAKER *of the Houſe of Commons*, a member of the houſe elected by a majority of the votes thereof, to act as a chairman or preſident, in putting queſtions, reading briefs or bills, keeping order, reprimanding the refractory, adjourning the houſe, &c.

The firſt thing done by the Commons, at the firſt meeting of a parliament, is to chooſe a ſpeaker, who is to be approved of by the king, and who, upon admiſſion, begs his majeſty, that the commons, during their ſitting, may have free acceſs to his majeſty, freedom of ſpeech in their own houſe, and ſecurity from arreſts.

The ſpeaker is not allowed to perſuade or diſſuade, in paſſing of a bill; but only to make a plain and ſhort narrative; nor to vote, unleſs the houſe is equally divided. The lord chancellor, or keeper, is uſually ſpeaker of the houſe of lords. The ſpeaker of the convocation is called the prolocutor.

SPEAKING, the art or act of expreſſing one's thoughts in articulate ſounds or words.

SPECIAL, ſomething that is particular, or has a peculiar deſignation, from the Latin, *ſpecies*, in oppoſition to general, of *genus*.

SPECIES, an idea which relates to ſome other more general one; or is compriſed under a more univerſal diviſion of a genus.

The word is Latin, derived from the ancient verb *ſpecio*, to ſee.

Species is a mere term of relation: and the ſame idea may be a ſpecies, when compared to another more general one; and a genus, with regard to a more particular one. Thus body is a genus with regard to an animate and inanimate body; and a ſpecies with regard to ſubſtance.

What the accurate Artedi has given, as the definition of the ſpecies in ichthyology, is not confined to fiſhes alone, but, with proper regulations, may be made the baſis of real diſtinctions of ſpecies in all other natural bodies. Every fiſh which differs from all the other fiſhes of the ſame genus in ſome external part, whether that difference be in exceſs or defect, in number or proportion, or even in colour, provided that the difference be fixed and invariable, is properly to be called a diſtinct ſpecies.

The ſpecific differences of fiſhes are to be drawn from theſe circumſtances; but it is not to be ſuppoſed that every ſpecies differs in all of them; ſometimes only one, ſometimes more, occaſion the variation.

If any one fiſh, in regard to all the others of the ſame genus, is found to be poſſeſſed of ſome external part which they all want; as, for example, if it have cirri, tubercles in the ſhape of horns on the head, ſpines or prickles in the head, or on any other part of the body, the fiſh is then to be eſteemed a diſtinct ſpecies. If one fiſh differs from the others of the ſame genus, in the number of any parts, as fins, ſpines or tubercles, it is then alſo a diſtinct ſpecies. If one fiſh differs from another in the proportion of any eſſential part, as in the having longer jaws, longer teeth, or the like, it is alſo to be eſteemed a truly different ſpecies. If one fiſh differs from another in the figure of ſome eſſential part, as of the ſnout, the back, the teeth, or the tail, or the lineæ laterales, it is to be eſteemed a diſtinct ſpecies. If one fiſh differs from another of the ſame genus in the exceſs of parts, having ſome part that is deficient in the other; or if in number, proportion, or figure of ſome of the eſſential parts; the diſtinction will be the more evident as the greater number of parts differ, and the ſpecies will eaſily be found to be truly diſtinct.

SPECIES, in logic, is one of the five words called by Porphyry univerſalis.

SPECIES, in optics, the image painted on the retina, by the rays of light reflected from the ſeveral points of the ſurface of an eye.

SPECIES, in rhetoric, is a particular thing, contained under a more univerſal one.

SPECIES, in commerce, are the ſeveral pieces of gold, ſilver, copper, &c. which having paſſed their full preparation and coinage, are current in public.

SPECIES, in algebra, the characters or ſymbols made uſe of to repreſent quantities.

SPECIES, in pharmacy, denotes the ingredients of a compound medicine, as the diaſcordium in a dry form, or only reduced powder.

The ſpecies aromaticæ, according to the Edinburgh Diſpenſatory, conſiſt of equal parts of canella, leſſer cardamom-ſeeds, mace, and ginger, reduced to powder: but the college of phyſicians in London, order them to be made of cinnamon, two ounces; and leſſer cardamom-ſeeds huſked, ginger, and long pepper, of each one ounce, all beat together into a powder. Both theſe compoſitions are agreeable, hot, ſpicy medicines; and as ſuch may be uſefully exhibited in cold phlegmatic habits and decayed conſtitutions, for warming the ſtomach, promoting digeſtion, and ſtrengthening the tone of the viſcera in general. The doſe is from ten grains to a ſcruple and upwards.

Change of SPECIES, a term made uſe of in huſbandry to expreſs an expedient the farmer often has recourſe to, in order to procure good crops: this is the ſowing firſt one kind of plant, then another, and then a third, and ſo on, upon the ſame land: by this means the moſt is made of the ſoil; and it is found, when it will no longer give a good crop of the firſt corn planted on it, it will ſtill give a good one of ſome other ſpecies; and, finally, of peaſe after all. After this laſt change of ſpecies, it is found neceſſary, in the common method of huſbandry, to renew the land with fallowing and manure, in order to its producing any thing again.

This change of ſpecies has been a practice of the farmers of all times, and is recommended, and judged neceſſary, by moſt of the writers on this ſubject: but Tull, in his New Syſtem of Horſe-hoeing Huſbandry, proves that it is not neceſſary, and that the land only wants proper tillage, when exhauſted by one ſort of corn, to enable it to produce as good crops of the ſame corn again. The three fundamental propoſitions he lays down to prove this, are, firſt, that plants of the moſt different nature feed on the ſame ſorts of foods Secondly, that there is no plant but what muſt rob every other plant, within its reach, of a part of its nouriſhment. And, thirdly, that a ſoil, which is once proper for any kind of vegetable, will continue to be always proper for it, in reſpect to the ſort of food it gives. If only any one of theſe propoſitions were true it would follow, that there is no need of a change of ſpecies from year to year; and as they are all ſo, this truth is yet the more inconteſtable; and experience proves it yet more evidently, for the ſame land will produce crops of wheat every year, without any change, only by the practice of the horſe-hoeing huſbandry, inſtead of the common.

SPECIFIC, in philoſophy, that which is peculiar to any thing, and diſtinguiſhes it from all others.

SPECIFIC, in medicine, a remedy, whoſe virtue and effect is peculiarly adapted to ſome certain diſeaſe, is adequate thereto, and exerts its whole force immediately thereon.

The illuſtrious Hoffman has given a curious account of ſpecific medicines, but it is too long to be inſerted here.

SPECIFIC GRAVITY, is that by which one body is heavier than another of the ſame dimenſion, and is always as the quantity of matter under that dimenſion.

Thus a cubical inch of iron is heavier than a cubical inch of wood; for the particles which compoſe the iron being more ſolid, and more cloſely compacted together; or, which is the ſame, having fewer interſtices or vacuities between them, than thoſe of the wood; there is actually more matter contained under the ſame dimenſions in iron than wood; and, therefore, is ſaid to be ſuperficially heavier than wood.

SPECILLUM, or SPECULUM, an inſtrument uſed by ſurgeons for ſearching and dilating wounds.

SPECIOUS ARITHMETIC, that managed and performed by ſymbols; now generally called algebra. See ALGEBRA.

SPECTACLES, in dioptrics, a machine conſiſting of two lenſes, ſet in ſilver, horn, &c. to aſſiſt the defects of the organ of ſight.

Old people, and others who have flat eyes, uſe convex ſpectacles, which cauſe the rays of light to converge ſo as to fall upon the retina: whereas myopes, or ſhort-ſighted perſons, uſe concave lenſes for ſpectacles, which cauſing the rays to diverge, prevent their meeting before they reach the retina. The convexity or concavity of the glaſſes, ſuited to the different degrees of flatneſs or convexity of people's eyes, is beſt determined by trial; obſerving only to uſe thoſe glaſſes which are the leaſt convex or concave of any, that will fit the eye: for ſince they cannot be put quite cloſe to the eye, the leſs any glaſs is convex or concave, the leſs it will magnify or diminiſh the pictures of objects upon the retina.

Were there no other uſe of dioptrics, than that of ſpectacles for defective eyes, the advantage that mankind receives thereby is certainly inferior to none other whatſoever, that is not abſolutely requiſite to the ſupport of life; for as the ſight is the moſt noble of all our ſenſes, ſurely that inſtrument that relieves the eyes when decayed, and ſupplies their defects, rendering them uſeful when otherwiſe almoſt uſeleſs, muſt needs, of all others, be eſteemed of the greateſt advantage.

The antients knew nothing of ſpectacles, the invention of which is ſaid to have been about the year 1300.

SPECULARIS LAPIS, in natural hiſtory, a genus of talcs, compoſed of large plates viſibly ſeparate, and of extreme thinneſs; and each fiſſile again ſeparated into a number of plates ſtill finer.

Of this genus there are three ſpecies: 1. The white ſhining ſpecularis, with large and broad leaves, commonly called iſinglaſs and muſcovy-glaſs: its lamellæ or leaves are extremely thin, elaſtic, and tranſparent; it makes not the leaſt efferveſcence with aquafortis, and is not eaſily calcined in the fire. It is imported in great quantities; the miniature-painters cover their pictures with it; the lantern-makers ſometimes uſe it inſtead of horn; and minute objects are uſually preſerved between two plates of it, for examination by the microſcope. 2. The bright brown ſpecularis, with broad leaves; a very valuable ſpecies, tho' inferior to the former. 3. The purple bright ſpecularis, with broad leaves; which is the moſt elegant of all the talcs, and not leſs beautifully tranſparent than the firſt kind.

SPECULATIVE, ſomething relating to the theory of ſome art or ſcience, in contradiſtinction to practical.

SPECULUM, MIRROR, in optics, any poliſhed body impervious to the rays of light; ſuch as water in wells and deep rivers, poliſhed metals, and glaſſes lined with mercury, or other opaque matter, popularly called looking-glaſs.

SPEECH, the art or act of expreſſing a perſon's thoughts by certain ſigns invented for that purpoſe.

SPEECH, in grammar, denotes an aſſemblage of ſeveral words ranged in order.

Grammarians generally make eight parts of ſpeech, i. e. eight kinds of words, generally uſed in diſcourſe, viz. noun, pronoun, verb, participle, adverb, prepoſition, interjection, and conjunction; each of which ſee under its proper article.

Others, particularly Engliſh grammarians, refer all words to four general heads or claſſes, viz. 1. Such words as denote things actually exiſting, or their properties, which are called nouns or names, as *houſe*, *tree*, *man*, *horſe*, *convenient*, *large*, &c. 2. Such words as expreſs action or paſſion, as *I love*, *I am loved*; and theſe are called verbs or affirmations. 3. Such words as denote the manner or way of doing or ſuffering, as *ſwiftly*, *ſlowly*, &c. which are called adverbs. 4. Particles, or ſuch ſmall words as ſerve to connect others together, in forming a ſentence, as, *and*, *or*, *alſo*, *before*, *after*, &c.

SPELL, in general, denotes the ſame with charm or amulet. See the articles CHARM and AMULET.

In the ſea-language, the word ſpell ſignifies to do any work for a ſhort time, and then leave it; therefore, a freſh ſpell is when freſh men come to work; and to give a ſpell, is to work in another's room.

SPELLING, in grammar, that part of orthography which teaches the true manner of reſolving words into their ſyllables. See ORTHOGRAPHY.

All words are either ſimple or compound, as *uſe*, *diſuſe*; *done*, *undone*; and the rules for dividing each, muſt be ſuch as are derived from the analogy of language in general, or from the eſtabliſhed cuſtom of ſpeaking; which, for the Engliſh language, are reduced to the following rules: 1. A conſonant between two vowels muſt be joined with the latter in ſpelling, as *na-ture*, *ve-ri-ly*, *ge-ne-rous*: except, however, the letter *x*, which is joined to the firſt, as in *flax-en*, *ox-en*, &c. and compound words, as in *up-on*, *un-uſed*, &c. 2. A double conſonant muſt be divided, as in *let-ter*, *man-ner*, &c. 3. Thoſe conſonants which can begin a word, muſt not be parted in ſpelling, as in *de-fraud*, *re-prove*, *di-ſtinct*: however, this rule is found ſometimes to fail; for though *gn* begins a word, as *gnaw*, *gnat*, &c. yet it muſt be divided in ſpelling, as in *cog-ni-zance*, *ma-lig-ni-ty*, &c. 4. Thoſe conſonants which cannot begin a word muſt be divided, as *ld* in *ſel-dom*, *lt* in *mul-ti-tude*, *mp* in *temper*, *rd* in *ardent*; but, in final ſyllables, there are exceptions, as *tl* in *ti tle*, *dl* in *handle*, &c. 5. When two vowels come together, and are both of them diſtinctly ſounded, they muſt be ſeparated in ſpelling, as in *co-e-val*, *mu-tu-al*, &c. 6. The grammatical terminations, or endings, muſt be ſeparated in ſpelling, as *ed* in *wing-ed*, *edſt* in *de-li-ver-edſt*, *ing* in *hear-ing*, *ance* in *de-li-ver-ance*, &c. 7. Compound words muſt be reſolved into their ſimple or component words, as *up-on*, *in-to*, *never-the-leſs*, *not-with-ſtand-ing*, &c.

SPELTER, in natural hiſtory, the ſame with zinc. See ZINC.

SPERMA-CETI, in pharmacy, a white flaky ſubſtance, prepared from the oil of a ſpecies of whale, called by ichthyologiſts catodon, by reaſon it has teeth only in the under jaw.

The ignorance of the people who firſt uſed this medicine, gave it a name which ſeemed to expreſs its being the ſemen of the whale; but it is, in reality, no more than a preparation of the oil with which that fiſh abounds.

Sperma-ceti is a fine, bright, white, and ſemi-pellucid ſubſtance, compoſed of a fine furfuraceous ſubſtance, formed into oblong flakes, very light, ſoft, and unctuous to the touch, inflammable, ſoluble in oil, but not in watery menſtrua; of ſcarce any ſmell, when freſh and fine, and of a ſoft, agreeable, and unctuous taſte. The largeſt, firmeſt, and whiteſt flakes of it are to be choſen. It is liable to become rancid and yellowiſh in keeping, and the ſmaller fragments contract this bad quality ſooner than the larger.

The firſt knowledge the world ſeems to have had of ſperma-ceti, was the finding it ſwimming on the ſurface of the water in the Northern Seas: and we are not to wonder that people who knew no more of its origin than

what they were informed of by thoſe who found it ſo floating on the ſea, referred it to the mineral claſs, ſuppoſing it to be bitumen formed in the bowels of the earth, and thrown up from the bottom of the ocean, as was the opinion of Schroder, and others of his time. It was ſoon after diſcovered, however, that the head of a peculiar ſpecies of whale afforded a fatty ſubſtance, which, when boiled, and properly prepared, was analogous to this. And hence it was ſoon deduced, that the maſſes of it firſt found were of the ſame origin; that they had been, formerly, an oily matter in this fiſh, which, getting looſe on the periſhing of the dead carcaſe, or by any other means, had been waſhed and bleached by the ſalt water, and the ſun, into the form in which it was then found. The opinion of its being the ſperm or ſemen of the whale, was about as early as the firſt diſcovery that it belonged to that animal, and ſeems to have been formed merely on account of its whiteneſs.

The ſpecies of whale from the head of which ſpermaceti was firſt prepared, and to which it was long thought to be peculiar, is of the number of thoſe ranged in a peculiar genus by Artedi, under the name of catodon, from their having teeth in their under jaw. He has diſtinguiſhed this ſpecies by the name of catodon fiſtula in cervice, the toothed whale, with a pipe or opening for the diſcharge of water in its neck. See WHALE.

The ſpermaceti of the ſhops was firſt made from the head of this fiſh; the oil obtained from its brain, and the diploe of the cranium, furniſhing all that we had of it; and hence the conſiderable price it was long kept at. It was ſome time after found out, however, that any whale-oil would do as well as this, which occaſioned the price to fall conſiderably. At preſent it is made in England from whale-oil of any kind, the ſettlings of our oilmen's larger veſſels particularly, which are boiled with a lixivium of German pot-aſh, or pearl-aſhes, till white and firm; and after ſeveral other meltings, and a thorough ſeparation of what ſaline particles might have got into the matter, it is, when cold, cut out with knives into the flakes we ſee it in. The proceſs is eaſy, but it requires care, and a nice inſpection towards the end: if not enough boiled, it is apt to turn yellow, and ſoon grow rancid.

Spermaceti is, therefore, oil of the animal kind, rendered very ſweet, and fit for internal uſe. Its virtues are emollient and pectoral; it is good in coughs, and other diſorders of the breaſt; and excellent in external applications, ſuch as liniments, and the like: it readily diſſolves in oil, or other fatty ſubſtances, for the latter purpoſes; and for the former, it blends with the yolk of an egg, and after that mixture with an aqueous fluid, and makes a pleaſant emulſion.

SPERMATIC, in anatomy, ſomething belonging to the ſperm or ſeed.

The ſpermatic veſſels, called alſo vaſa præparantia, are certain veſſels appointed for bringing the blood to the teſticles, &c. to be ſecreted and prepared into ſeed, and for carrying back again the blood remaining after the ſecretion is effected. The ſpermatic veſſels are two arteries and as many veins. The ſpermatic arteries ariſe, by a very narrow origin, from the fore part of the trunk of the aorta, below the emulgents: their ſtructure is very ſingular, in that, contrary to the fabric of all other arteries, which are largeſt at their exit from the trunk, theſe are ſmalleſt at their origin, and grow bigger in their progreſs towards the teſtes; by this means the blood receives a check at its firſt going off for thoſe parts, which diſpoſes it for the future changes, &c. it is to paſs through. The ſame end is anſwered in quadrupeds, by having theſe arteries curled and contorted in their paſſage, like a ſcrew. The reaſon why nature has taken another method in man, Mr. Cowper obſerves, is, that in this caſe the abdominal muſcles muſt have been larger than they are; by which means the inteſtines would have been frequently let down into the ſcrotum; an inconvenience which quadrupeds are ſecured from, by the horizontal poſition of their bodies. The ſpermatic arteries, in their progreſs, meeting with the ſpermatic veins, enter together with them the inner lamella of the peritonæum; where inſinuating into the duplicature of the proceſs, and being cloathed therewith, they paſs on to within three or four fingers breadth of the teſticles, where they divide into two unequal branches, the biggeſt of which goes to the teſticle, and is diſtributed therein; and the leſſer in the paraſtata or epididymis.

The ſpermatic veins take the ſame courſe with the arteries, only a little above the teſticles they ſplit into ſeveral branches, which uniting, form a plexus called the corpus pampiniforme, or pyramidale. The blood returned by the ſpermatic veins, is delivered on the right-ſide to the cava, and on the left into the emulgent vein. Their nerves ariſe from the plexes of the pelvis and of the loins.

SPERMATOCELE, in medicine and ſurgery, a kind of rupture occaſioned by a diſtention of the ſeminal veſſels, whereby they are let fall into the ſcrotum.

SPHACELUS, in ſurgery and medicine, a total corruption or mortification of any part, occaſioned by an interception of the blood and ſpirits. Sphacelus is diſtinguiſhed from a gangrene, which is only a mortification begun, and, as it were, the road to a ſphacelus.

If a gangrene degenerates into a ſphacelus, the part infected muſt be removed; but the method of doing this is to be varied, according as the part is totally, or only partially affected, and according to the ſituation of the part, which ſometimes does not admit of amputation, as the buttocks, os ſacrum, os coccygis, the prominent ſpines of the vertebræ, and eminences of the ſcapulæ.

If the part is not corrupted to the very bottom, or cannot be extirpated, our endeavours muſt tend, firſt, to ſtop the progreſs of the ſphacelus; and, ſecondly, to remove the ſphacelated portion.—The progreſs is ſtopped by intercepting the communication betwixt the live and ſphacelated parts.

In the part thus mortified, all the humours remain at reſt in the veſſels, or, the veſſels being ruptured, the humours are diſcharged, and become ſtagnant; but ſo long as the coheſion between the mortified part remains, the fluids conveyed through theſe veſſels, which are, as yet, alive, will ſtop in the part where the ſphacelus begins, and, conſequently, the motion will be ſuffocated in the live parts contiguous to that which is mortified; and thus the diſorder will be propagated.

The infected part is ſeparated, if, after the progreſs of the diſorder is ſtopped, or whilſt it is ſtopping, the whole part is cauteriſed, or cut, to the ſound ſubjacent parts, and then corroded by the application of a warm acrid lixivium, till it is conſumed to the live parts, till eſchars are formed, which are carefully to be ſoftened and removed; but the live parts muſt, at the ſame time, be avoided with the greateſt caution.

The corroſive lixivium, recommended by Boerhaave, for procuring the ſeparation of a ſphacelus, is prepared thus:

Take of quick-lime made of calcined ſtones, one part. Cover it carefully up with three parts of pot-aſh, and, when they are diſſolved in a ſubterraneous place, filtrate and keep the preparation for uſe. Quick-lime itſelf, reduced to a powder, may alſo be ſprinkled on the part.

But ſeparations are moſt advantageouſly made, if the mortified eſchars, by the application of a putrefying remedy, ſo as to be diſſolved into a ſoft maſs, recede from the ſound part, whilſt the live parts are, in the mean time, cheriſhed with enlivening fomentations.

When the meaſures above recommended will not produce the deſired effect, we muſt proceed to amputation. See the article AMPUTATION.

SPHENOIDAL SUTURE, in anatomy, a ſuture thus called from its encompaſſing the os ſphenoides, which it ſeparates from the os frontis, the os petroſum, and the os occipitis.

SPHENOIDES, or OS CRUCIFORME, in anatomy, the ſeventh bone of the cranium, or ſkull.

This bone is fixed in manner of a wedge among the other bones of the cranium, and ſerves as a baſis, as it were, to ſupport ſeveral of them, and ſome of thoſe of the upper jaw: the figure of this bone is very irregular; in its upper part is ſeen the ſella equina, or turcica, under which there is a ſinus: this is ſometimes double, and opens into the noſtrils: ſometimes it is totally wanting: it is called the ſphenoidal ſinus. The ſphenoides has thirteen apophyſes; ſix of them are internal, and are placed near the ſella equina; and the other ſeven are external;

ternal; four of theſe are of a pterygoide form, and thence named pterygoide apophyſes; two of the other three are very ſmall and ſtyloide, and the ſeventh is placed under the vomer: there are alſo three foſſæ, or cavities, in this bone, one in the ſella equina, and the other between the pterygoide apophyſes.

SPHENOPHARYNGÆUS, in anatomy, a pair of muſcles, called alſo the pterygopharingæus.

SPHENOSTAPHYLINUS, in anatomy, a muſcle of the larynx. It deſcends from a round fleſhy origination, near the root of a proceſs of the os ſphenoides, and from thence runs obliquely to the uvula, and is inſerted into the hinder and upper part, where it joins its partner. It ſerves to draw the uvula upwards and backwards, and hinders the maſticated aliment from paſſing into the foramina narium, in deglutition.

SPHERE, *σφαιρα*, in geometry, a ſolid body contained under one ſingle ſurface, and having a point in them iddle called the center, whence all lines drawn to the ſurface are equal.

If the ſemi-circle ADB (plate CXXII. *fig* 3.) be turned about upon its diameter AD as an axis, the ſemi-periphery ABD will deſcribe the ſurface of a ſphere; and each point, as M, will deſcribe the circumference of a circle, whoſe radius will be MP, the right-ſine of the arch AM. Put $AP = x$, $PM = y$, $AC = r$, and the whole circumference $= c$; then, as $r : c :: y : \frac{cy}{r}$, the circumference deſcribed by the point M. Let M*m* be an infinitely ſmall arch, and draw *mp* parallel to MP; then will $MR = x$: and becauſe the triangles CMP and M*m*R are ſimilar, it will be as $PM : CM :: MR$ to M*m*. That is, $y : r :: x : \frac{rx}{y}$, which being multiplied by $\frac{cy}{r}$, the circumference, formed by the point M, will give $\frac{cyrx}{ry}, = cx$, the area of the increment formed by M*m*; this multiplied by Qr, or, which is the ſame thing, putting Qr in the room of x, we ſhall have Qcr for the intire ſurface of the ſphere; for, when M*m* becomes equal to ABD, x becomes equal to Qr.

Hence it is manifeſt, that the ſurface of the ſphere is equal to four times the area of the greateſt circle: for $Qcr =$ the ſurface of the ſphere, is equal to four times $\frac{cr}{2}$, the area of the greateſt circle; but as the diameter of any circle is to its circumference, ſo is the ſquare of the ſame diameter to the ſurface of the generated ſphere: therefore it will be as 1, to 3,14159, &c. ſo is the ſquare of the diameter of a ſphere to its ſuperficies; and, if we multiply its ſuperficies by $\frac{1}{6}$ of the diameter, the product will be the ſolidity.

Hence the ſquare of the diameter being multiplied by 3,14159, &c. or the ſquare of the radius by 12,56637, &c. the product will be the ſuperficial content.

SPHERE, in aſtronomy, that concave orb, or expanſe, which inveſts our globe, and in which the heavenly bodies appear to be fixed, and at an equal diſtance from the eye.

The better to determine the places of the heavenly bodies in the ſphere, ſeveral circles are ſuppoſed to be deſcribed on the ſurface thereof, hence called the circles of the ſphere: of theſe, ſome are called great circles, as the equinoctial, ecliptic, meridian, &c. and others, ſmall circles, as the tropics, parallels, &c. See each under its proper article.

Armillary SPHERE. See the article ARMILLARY *Sphere*.

SPHERE *of Activity of a Body*, is that determinate ſpace or extent, to which, and no farther, the effluvia continually emitted from that body, reach; and where they operate, according to their nature. See POWER.

SPHERICAL ANGLE, TRIANGLE, and TRIGONOMETRY. See the article ANGLE, TRIANGLE, and TRIGONOMETRY.

SPHERICS, is that part of geometry which treats of the poſition and menſuration of arches of circles, deſcribed on the ſurface of a ſphere.

SPHEROID, in geometry, a ſolid generated by the entire revolution of a ſemi-ellipſis about its axis.

The word is formed from the Greek *σφαιρα*, a ſphere, and *ειδος*, reſemblance.

When the figure is generated by the revolution of the ſemi-ellipſis about its tranſverſe or greater axis, it is called a prolate or oblong ſpheroid; and when generated by the revolution of a ſemi-ellipſis about its conjugate or leſſer diameter, it is called an oblate ſpheroid. Every ſpheroid is equal to two thirds of its circumſcribing cylinder.

As to the ſuperficies of a ſpheroid, Mr. Huygens gives the two following conſtructions in his *Horolog. Oſcill.* For deſcribing a circle equal to the ſuperficies of an oblong and prolate ſpheroid. 1. Let an oblong ſpheroid be generated by the rotation of the ellipſis ADBE, (plate CXXII. *fig.* 4.) about its tranſverſe axis AB, and let DE be its conjugate; make DF equal to CB, or let F be one of the foci, and draw BG parallel to FD, and about the point G, with the radius BG, deſcribe an arch, BHA, of a circle; then between the ſemi-conjugate CD, and a right line equal to DE + the arch AHB, find a mean proportional, and that will be the radius of a circle equal to the ſuperficies of the oblong ſpheroid. 2. Let a prolate ſpheroid be generated by the rotation of the ellipſis ADBE (*fig.* 5.) about its conjugate axis AB. Let F be one of the foci, and biſſect CF in G, and let AGB be the curve of the common parabola whoſe baſe is the conjugate diameter AB, and axis CG. Then if between the tranſverſe axis DE, and a right line equal to the curve AGB of the parabola, a mean proportional be taken, the ſame will be the radius of a circle equal to the ſurface of that prolate ſpheroid.

SPHINCTER, in anatomy, a term applied to a kind of circular muſcles, or muſcles in form of rings, which ſerve to cloſe and draw up ſeveral orifices of the body, and prevent the excretion of the contents of the ſphincter veſicæ. See the article BLADDER.

SPHINX, *σφιγξ*, in ſculpture, &c. a figure or repreſentation of a monſter of that name, famed among the ancients, now moſtly uſed as an ornament in gardens, terraces, &c. It is repreſented with the head and breaſts of a woman, the wings of a bird, the claws of a lion, and the reſt of the body like a dog. It is ſuppoſed to have been engendered by Typhon, and ſent by Juno to be revenged on the Thebans. Its office, they ſay, was to propoſe dark enigmatical queſtions to all paſſers by; and if they did not give the explication thereof, to devour them. It made horrid ravages, as the ſtory goes, on a mountain near Thebes, and could not by any means be deſtroyed, till after Œdipus had ſolved the following riddle. "What animal is it that in the morning walks on four legs, at noon on two, and at night on three?" The anſwer was, "Man."

Among the Egyptians, the ſphinx was the ſymbol of religion, by reaſon of the obſcurity of its myſteries: and on the ſame account the Romans placed a ſphinx in the porch of their temples.

SPICA VIRGINIS, a ſtar of the firſt magnitude, in the conſtellation Virgo. Its place is in the more ſoutherly hand. Its longitude, according to Mr. Flamſteed, is 19° 31′ 22″: its latitude, 2° 1′ 59″ ſouth.

SPICE, any kind of aromatic drug that has hot and pungent qualities: ſuch are pepper, nutmeg, ginger, cinnamon, cloves, &c.

Some alſo apply the word to divers other medicinal drugs brought from the Eaſt: as ſenna, caſſia, frankincenſe, &c.

SPIDER, in zoology, the name of a well known inſect, of which we have a great number of ſpecies.

The ſpider affords to the ſagacious obſerver, as well without as with the aſſiſtance of glaſſes, a great many extremely curious particulars. As the fly, which is the ſpider's natural prey, is an animal extremely cautious and nimble, and uſually comes from above, it was neceſſary the ſpider ſhould be furniſhed with a quick ſight, and an ability of looking upwards, forwards, and ſideways, at the ſame time; and the microſcope ſhews, that the number, ſtructure, and diſpoſition of its eyes, are wonderfully adapted to the ſerving all theſe purpoſes.

Moſt

Moſt ſpiders have eight eyes: two on the top of the head or body, for there is no diviſion between them, the ſpider having no neck; theſe look directly upwards: there are two more in front, placed a little below theſe, and diſcovering all that paſſes forwards, and on each ſide: a couple more, one whereof points ſideways forwards, and the other ſideways backward; ſo that it can ſee almoſt quite round it. All kinds of ſpiders have not, however, this exact proviſion; for in ſome we find ten, and in others only ſix, or four. The eyes of the ſpider are not pearled; and the field-ſpiders, or long-legs, have no more than two eyes.

Whatever be the number of the ſpider's eyes, they are however all immoveable and tranſparent, and are ſituated in a moſt curious manner. The beſt way of viewing them with the microſcope, is to cut off the legs and tail, and leave only the head for examination.

All ſpiders have eight legs, which they employ in walking; and two ſhorter, called arms, which they uſe in ſeizing their prey. All the legs are thickly beſet with hairs; each has ſix joints, and ends with two hooked claws, which are ſerrated on their inſide; by means of theſe teeth, or jags in their claws, they ſeize very faſt hold of any thing, and behind theſe there is a ſort of ſpur, which is perfectly ſmooth. Beſides theſe, nature has allotted this creature, for the ſeizing its prey, a pair of ſharp crooked claws, or forceps, in the forepart of its head. Theſe ſtand horizontally, and, when not exerted for uſe, are concealed in two caſes contrived for their reception, in which they fold like a claſp-knife, and there lie between two rows of teeth, which are likewiſe employed to hold faſt the prey.

Each of theſe claws, or pincers, has a ſmall ſlit near its point, according to Lewenhoeck, like that in a viper's tooth, through which he ſuppoſes that a poiſonous juice is, in like manner, thrown out. But Dr. Mead, in his Eſſay on Poiſons, diſſents wholly from this opinion, having never been able, on repeated examinations, to diſcover any ſuch opening, not even in the claws of the great American ſpider; which, being above fifty times bigger than any of the European ſpiders, would more eaſily have diſcovered this opening, if nature had allotted any to this part of the animal. Beſides, repeated obſervations alſo convinced him that nothing dropped out of the claws, which were always dry, while the ſpider bit any thing, but that a ſhort white proboſcis was, at the ſame inſtant, thruſt out of the mouth, which inſtilled a liquor into the wound. And the ſame author obſerves, that the quantity of liquor, emitted by our common ſpiders when they kill their prey, is viſibly ſo great, and the wounding weapons ſo minute, that they contain but a very inconſiderable portion thereof, if it were to be diſcharged that way. *Baker's Microſcope.*

Spiders frequently caſt their ſkins, which may be found in their webs perfectly dry and tranſparent; and from ſuch ſkins the forceps, or claws, for they are always ſhed with the ſkins, may eaſier be ſeparated, and examined with much greater exactneſs, than in the common ſpider while living.

The ſpider's manner of weaving its web is very wonderful. The creature has five little teats, or nipples, near the extremity of the tail; from theſe there proceeds a gummy liquor, which adheres to every thing it is preſſed againſt, and, being drawn out, hardens inſtantly in the air, and becomes a ſtring, or thread, ſtrong enough to bear five or ſix times the weight of the ſpider's body. This thread is compoſed of ſeveral finer ones, which are drawn out ſeparately, but unite together at two or three hairs breadth diſtance from the creature's body. Theſe threads are finer or coarſer, according to the bigneſs of the ſpider that ſpins them. Mr. Lewenhoeck has computed, that a hundred of the ſingle threads of a full grown ſpider are not equal to the diameter of the hair of his beard; and conſequently, if the threads and hair be both round, ten thouſand ſuch threads are not bigger than ſuch a hair. He calculates farther, that, when young ſpiders firſt begin to ſpin, four hundred of them are not larger than one which is of full growth: allowing which, four millions of a young ſpider's threads are not ſo big as the ſingle hair of a man's beaad.

The eggs of ſome ſpiders are a very pleaſing microſcopic object; they are round at one end, and flattiſh at the other, with a depreſſion in the center of the flattiſh end, and a yellowiſh circle round it. The colour of theſe eggs is a pearly or bluiſh white, and when the young ſpiders hatch, they come out in their perfect form, and run about very nimbly.

The female ſpider depoſits her eggs, to the number of five or ſix hundred, in a bag compoſed of her own web, which ſhe either carries under her belly, or hides in ſome very ſafe receſs. *Phil. Tranſ.* N°. 272.

SPIEL, in the glaſs-trade, an iron inſtrument, hooked at the end and pointed, with which the workmen take the metal up out of the melting-pots, for proofs or eſſays, to ſee whether it be fit for work.

SPIKE, or *Oil of* SPIKE, a name given to an eſſential oil diſtilled from lavender, and much uſed by the varniſh-makers, and the painters in enamel, and of ſome uſe in medicine. It is brought from Provence, and other parts of France, where the lavender is called aſpic, and thence came the name of oil of ſpike. This oil, when in perfection, is very limpid; of a pleaſant yellowiſh colour; very fragrant; poſſeſſing, in an eminent degree, the peculiar ſmell generally admired in the flowers. In medicine it is uſed, both externally and internally, in paralytic and lethargic complaints, rheumatic pains, and debilities of the nervous ſyſtem. The doſe is from one drop to five or ſix; but our artificers, in their varniſhes, uſe more of this oil than the apothecaries do: and wanting it at a cheap rate, they have taught the druggiſts, who uſed to import and ſell it to them, ſo many ways of adulterating it, that at preſent it is ſcarce any where to be met with genuine: and ſo coarſe an ingredient as common oil of turpentine is uſed as the baſis of all the counterfeits: they alſo ſometimes adulterate it with ſpirit of wine. But both theſe cheats are eaſily diſcovered: that mixed with ſpirit of wine may be known by only mixing the whole with water, in which caſe the water, uniting with the ſpirit, leaves the oil at the top alone; that mixed with oil of turpentine, is diſcovered by burning a ſpoonful of it; for the genuine oil of ſpike burns with a clear flame and without ſmoke, and its ſmell, while burning, is very fragrant; whereas, when there is oil of turpentine mixed, it burns more furiouſly, emits a thick ſmoke, and is of a very bad ſmell. This oil is diſtilled from the ſmaller ſpecies of lavender, in the common way, by the alembic. See LAVANDULA.

SPINA BIFIDA, in anatomy, a parting of the ſpinal proceſſes into two rows: the exiſtence of ſuch a caſe is doubted. See SPINE.

SPINA VENTOSA, in ſurgery and medicine, that ſpecies of corruption of the bones which takes its riſe in the internal parts, and by degrees enlarges the bone, and raiſes it into a tumour, and which, when it happens to children, is termed by Severinus, and many others, pædarthrocaces.

SPINACHIA, or SPINACIA, SPINACH, or SPINNAGE, in botany, a genus of plants: it hath an apetalous flower conſiſting of many ſtamina included in the flower-cup, which are produced in ſpikes upon the male plants, which are barren; but the embryoes are produced from the wings of the leaves on the female plants, which afterwards becomes a roundiſh or angular ſeed, which in ſome ſorts has thorns adhering to it.

Winter ſpinage ſhould be ſown upon an open ſpot of ground towards the latter end of July, obſerving, if poſſible, to do it when there is an appearance of rain: for, if the ſeaſon ſhould prove dry for a long time after the ſeed is ſown, the plants will not come up regularly; and many times there will not be half a crop. When the ſpinage is come up, the ground ſhould be hoed to deſtroy the weeds, and alſo to cut up the plants where they are too cloſe, leaving the remaining plants about three or four inches aſunder: but this ſhould always be done in dry weather, that the weeds may be deſtroyed ſoon after they are cut.

About a month or five weeks after the firſt hoeing, the weeds will begin to grow again; therefore the ground ſhould be then hoed again the ſecond time, obſerving, as before, to do it in dry weather. But if the ſeaſon ſhould prove moiſt, it will be proper to gather the weeds up after they

they are cut, and carry them off the ground; for, if the ſpinage is not cleaned from weeds before winter, they will grow up, and ſtifle it ſo, that in wet weather the ſpinage will rot away.

In October, the ſpinage will be fit for uſe; when you ſhould only crop off the largeſt leaves, leaving thoſe in the center of the plants to grow bigger; and thus you may continue cropping it all the winter and ſpring, until the young ſpinage, ſowed in the ſpring, is large enough for uſe, which is commonly in April; at which time the ſpring advancing, the winter ſpinage will run up to ſeed; ſo that you will cut it up, leaving only a ſmall parcel to produce ſeeds.

The two ſorts with ſmooth ſeeds produce much larger and thicker round leaves than the former; but, being ſomewhat tenderer, are always ſown in the ſpring.

Theſe are either ſown upon an open ſpot of ground, by themſelves, or elſe mixed with radiſh-ſeed, as is the common practice of the London gardeners, who always endeavour to have as many crops from their land in a ſeaſon as poſſible; but, where land is cheap in the country, it will be the better method to ſow it alone without any other ſort of ſeed mixed with it; and, when the plants are come up, the ground ſhould be hoed to deſtroy the weeds, and cut out the plants where they are too cloſe, leaving the remaining about three inches aſunder; and, when they are grown ſo large as to meet, you may then cut off a part of it for uſe, thinning the plants that they may have room to ſpread; and this thinning may be twice performed, as there is occaſion for the ſpinage; at the laſt of which, the roots ſhould be left eight or ten inches aſunder. If then you hoe the ground over again, to deſtroy the weeds, it will be of great ſervice to the ſpinage; for, if the land is good upon which it was ſown, the third ſort, with this management, will many times produce leaves as large as the broad-leaved dock, and be extremely fine.

But, in order to have a ſucceſſion of ſpinage through the ſeaſon, it will be proper to ſow the ſeed at three different times in the ſpring; the firſt, early in January, which muſt be on a dry ſoil; the ſecond, the beginning of February, upon a moiſter ſoil: and the third, the beginning of March, which ſhould be on a very moiſt ſoil: and this third ſowing ſhould be hoed out thinner at the firſt time of hoeing it, than either of the ſowings; for there will be no neceſſity to leave it for cutting out thin for uſe, becauſe the former ſowings will be ſufficient to ſupply the table till this third ſowing is full grown; beſides, by leaving it thin at firſt, it will not be apt to run up to ſeed ſo ſoon as it would if the plants were cloſe. *Miller's Gard. Dict.*

SPINALIS, in anatomy, the names of ſeveral muſcles, &c. of the ſpine, but more particularly that of a muſcle on the ſide of the neck, ariſing from the five ſuperior proceſſes of the vertebræ of the thorax, and the inferior of the neck; and which in its aſcent, becoming more fleſhy, is inſerted into the inferior part of the vertebræ of the neck laterally. It ſerves to draw the neck backwards.

Other muſcles of the back, neck, &c. called by ſome anatomiſts ſpinalis, are, 1. The Spinalis cervicis, called by others tranſverſalis: 2. Spinales colli minores, are muſcles lying between the ſix ſpinal apophyſes of the neck, and between the laſt of the neck and the firſt of the back, called by ſome interſpinales. Other muſcles of this name are, 3. The ſpinalis dorſi, being called by ſome, a part of the ſemi-ſpinatus; and by others, a part of the longiſſimus dorſi. 4. The ſpinalis dorſi major, is a pretty long and ſlender muſcle, lying upon the lateral parts of the extremities of the ſpinal apophyſes of the back, called, by ſome, ſemi-ſpinalis. 5. Spinales dorſi minores are muſcles of two kinds, ſome going laterally from the extremity of one ſpinal apophyſes to another, being often mixed with the ſhort faſciculi of the ſpinalis major; the reſt lie directly between the extremities of two neighbouring ſpinal apophyſes; being ſeparated from thoſe on the other ſide by the ſpinal ligament; theſe are ſometimes termed interſpinales. 6. Spinales, and tranſverſales lumborum, are ſome faſciculi which run up from the ſuperior falſe ſpines of the os ſacrum, to the lower ſpinal apophyſes of the loins.

The ſpinal acceſſory nerve of Willis, is a ſort of ninth pair of nerves of the neck, ariſing from the ſpinal marrow, about the origin of the third or fourth pair, and paſſing through the great foramen of the os occipitis up into the cranium: it is then joined to the par vagum, and coming out of the cranium again by the ſame aperture, it recedes from the par vagum, and is bent back to the muſculus ſcapulæ cucullaris or trapezius.

SPINE, SPINA-DORSI, in anatomy, the bony column reaching from the head down to the anus; being the ſeries or aſſemblage of vertebræ which ſuſtain the reſt of the body, contain the ſpinal marrow, and to which the ribs are connected.

The uſual diviſion of the ſpine is into the neck, the back, the loins, and the os ſacrum and coccygis.

Luxations, fractures, and other injuries of the SPINE. The ſigns common to luxations in the ſpine are chiefly the following: The back itſelf is found to be crooked, after ſome external violence has been inflicted upon it; the patient can neither ſtand nor walk, and his whole body ſeems to be paralytic; the parts which are beneath the luxated vertebræ are nearly without all ſenſe and motion; the excrements and urine cannot be diſcharged, or elſe they are ſometimes emitted involuntarily; the lower extremities grow dead by degrees, and at length death itſelf follows: but theſe ſymptoms vary in proportion to the degree of violence in the luxation. Where there is but one vertebra luxated, the curvature is gibbous, making a ſort of angle: if the proceſſes of the vertebræ are diſplaced forwards, then the ſpine will ſeem to bend inwards, and the pains will be more gentle when the patient lies on his back: if the vertebra is luxated on the right ſide, the body will incline towards the left, and vice verſa. Luxations of the ſpinal vertebræ are in general very difficult to reduce; but the following ſeems to be the beſt method of reducing them, according to Heiſter: When the apophyſes are diſlocated on both ſides, the patient is to be laid leaning upon his belly over a caſk, drum, or ſome other gibbous body, and then two aſſiſtants are ſtrongly to preſs down both ends of the ſpine on each ſide; then the ſurgeon is to preſs down the luxated vertebræ, and at the ſame time to puſh nimbly the ſuperior part of the body upwards, by which means the luxated vertebra are ſometimes commodiouſly reduced into their right places: but if ſucceſs ſhould not attend the firſt time, the method ſhould be repeated two or three times more. When the vertebra comes out on one ſide, the patient is then to be placed as before, but ſo that when the left apophyſis is diſplaced, one aſſiſtant may preſs the lower vertebræ inwards to the right, and another aſſiſtant may depreſs the right humerus, and vice verſa. For the remainder, it ſeems proper, after the vertebræ are reduced, to bathe the ſpine with ſpirit of wine, or to lay on compreſſes dipped in ſpirit of wine camphorated, and to bind the parts up with the napkin and ſcapulary.

When any of the vertebræ are fractured either by a fall, blow, or any other cauſe, without hurting the ſpinal marrow, it is to be ſuppoſed that the fracture is confined to ſome of the oblique or ſpinal proceſſes, and therefore the patient will be in no great danger; but when the body of the vertebræ is either broke or ſplit, and the contiguous ſpinal marrow bruiſed or compreſſed, all the parts of the limbs and viſcera beneath that vertebra will become immoveable and rigid, and death will ſooner or later follow the accident: and if the tranſverſe proceſſes of the vertebræ are broke, which incline towards the cavity of the thorax, it is ſcarce poſſible that the heads of the ribs, which are there connected, ſhould eſcape being fractured. Theſe fractures are to be judged of from the nature of the external violence which occaſioned them, from the pains ſeated about the affected vertebra, and from the touch, eye, &c. When only the proceſſes of the vertebræ are found broken, it will be much the beſt way to force them into their places with the fingers, placing narrow compreſſes dipt in warm ſpirit of wine on each ſide of the vertebræ, and over them ſlips of thick paſteboard, to be kept on by the napkin and ſcapulary.

When the ſpine is ſo injured that the ſpinal marrow is wounded, ſuch wounds as are ſlight may be dreſſed with Peruvian balſam, eſſence of myrrh, or medicines of a like nature, mixed with a quantity of honey of roſes

ſpread upon a pledget, and applied moderately warm; by which means, if the patient is of a good conſtitution, the parts ſometimes heal, but large wounds here bring certain death.

SPINET, or SPINNET, a muſical inſtrument ranked in the ſecond or third place among the harmonious inſtruments of the ſame nature with the harpſichord.

This inſtrument has its name from the ſmall quills that ſtrike the ſtring being ſuppoſed to reſemble *ſpinæ*, or thorns. See HARPSICHORD.

SPINNING, in commerce, the act or art of reducing ſilk, flax, hemp, wool, hair, or other matters, into thread. Spinning is either performed on the wheel with a diſtaff and ſpindle, or with other machines proper for the ſeveral kinds of working. Hemp, flax, nettle-thread, and the like vegetable matters, are to be wetted in ſpinning; ſilks, wools, &c. are to be ſpun dry, and do not need water; but there is a way of ſpinning ſilk as it comes off the caſes or balls, where hot and even boiling water is to be uſed.

SPINOSISM, the doctrine of Spinoſa; or atheiſm and pantheiſm, propoſed after the manner of Spinoſa.

Benedict Spinoza, or Eſpinoza, was a man well known in Holland. He was born a Jew at Amſterdam, but did not make profeſſion of any religion, either the Jewiſh or Chriſtian.—He compoſed ſeveral books in Latin; the moſt celebrated whereof is his Tractatus Theologico-Politicus, wherein he endeavours to overturn the foundation of all religion: the book, accordingly, was condemned by a public decree of the ſtates; though it has ſince been ſold publicly, and even reprinted, both in Latin and French, in that country, and lately in Engliſh at London.

Spinoza, here, inſinuates, that all religions are only political engines, calculated for the public good; to render the people obedient to magiſtrates, and to make them practiſe virtue and morality.

He does not here lay down his notion of the Deity openly, but contents himſelf with ſuggeſting it.—In his Ethics, publiſhed among his poſthumous works, he is more open and expreſs; maintaining, that God is not, as we imagine him, an infinite, intelligent, happy, and perfect being; nor any thing, but that natural virtue, or faculty, which is diffuſed throughout all creatures.

Spinoza, in his Tractatus above-mentioned, is very full on the ſubject of the authors of the ſcriptures; and endeavours to ſhew, that the Pentateuch is not the work of Moſes, contrary to the common opinion, both of the Jews and Chriſtians. He has alſo his particular ſentiments, as to the authors of the other books.—This part of the work has been anſwered by M. Huet, in his Demonſtratio Evangelica: and by M. Simon, in his Hiſt. Crit. du Vieux Teſt.

Spinoſiſm is a ſpecies of naturaliſm, or pantheiſm, or hylotheiſm, as it is ſometimes called, that is, of the dogma which allows of no other God but nature, or the univerſe; and, therefore, makes matter to be God. Accordingly, Buddeus, in a diſſertation De Spinoziſmo ante Spinozam, proves at large, that Spinoza's doctrine of God and the world is far from being his own invention, but that it had been held by many philoſophers of different ſects, both among the Chaldeans and Greeks. It is certain, the opinion of the Stoics, and thoſe who held an anima mundi, was not far from it. Lucan introduces Cato diſcourſing thus:

Eſtne Dei ſedes niſi terra, & aër,
Et cœlum, & virtus? ſuperos quid quærimus ultra!
Jupiter eſt quodcunq; vides, quocunq; moveris.

LUC. PHARS. *lib.* ix. v. 578.

Strato likewiſe, and others among the Peripatetics, maintained ſomething very like it; and what is more, though no ancient ſect ſeems farther removed from Spinoſiſm than the Platonic, as they attributed the greateſt freedom to God, and carefully diſtinguiſhed him from matter; yet Gundlingius has proved at large, that Plato gave matter much the ſame origin with Spinoza. But the ſect that approached neareſt to Spinoſiſm, was that which taught that all things were one, as Xenophanes the Colophonian, Parmenides Meliſſus, and eſpecially Zeno Eleates, whence it obtained the name of the Eleatic ſyſtem of atheiſm. To the ſame may alſo be reduced the opinion of thoſe, who held the firſt matter for God, as Almaricus and David of Dinantum. Add, that the ſect of Foe in China and Japan, that of the Soufi in Perſia, and that of the Zindikites in Turky, are found to philoſophiſe much after the manner of Spinoza.

The chief articles in Spinoza's ſyſtem are reducible to theſe: That there is but one ſubſtance in nature; and that this only ſubſtance is endued with an infinite number of attributes, among which are extenſion and cogitation. That all the bodies in the univerſe are modifications of this ſubſtance conſidered as it is extended; and that all the ſouls of men are modifications of the ſame ſubſtance, conſidered as cogitative. That God is a neceſſary and infinitely perfect being, and is the cauſe of all things that exiſt, but is not a different being from them. That there is but one being and one nature; and that this nature produces, within itſelf, by an immanent act, all thoſe which we call creatures. And that this being is at the ſame time both agent and patient, efficient cauſe and ſubject; but that he produces nothing but modifications of himſelf.

Thus is the Deity made the ſole agent as well as patient in all evil, both phyſical and moral; that called *malum pœnæ*, as well as *malum culpæ*: a doctrine fraught with more impieties than all the heathen poets have publiſhed concerning their Jupiter, Venus, Bacchus, &c. What ſeems to have led Spinoza to frame this ſyſtem, was the difficulty of conceiving either that matter is eternal, and different from God, or that it could be produced from nothing, or that an infinite and free Being could have made a world ſuch as this is. A matter that exiſts neceſſarily, and which nevertheleſs is void of activity, and ſubject to the power of another principle, is an object that ſtartles our underſtanding; as there ſeems no agreement between the three conditions.—A matter created out of nothing is no leſs inconceivable, whatever efforts we make to form an idea of an act of the will that can change what before was nothing into real ſubſtance. Beſides, its being contrary to that known maxim of philoſophers, *Ex nihilo nihil fit*. In fine, that an infinitely good, holy, free Being, who could have made his creatures good and happy, ſhould rather chooſe to have them wicked, and eternally miſerable, is no leſs incomprehenſible; and the rather, as it ſeems difficult to reconcile the freedom of man with the quality of a being made out of nothing.

Theſe appear to have been the difficulties which led Spinoza to ſearch for a new ſyſtem, wherein God ſhould not be diſtinct from matter, and wherein he ſhould act neceſſarily, and to the extent of all his power, not out of himſelf, *ad extra*, but within himſelf. But it is certain, if the new ſyſtem reſcue us from ſome difficulties, it involves us in others much greater. For,

1. It is impoſſible the univerſe ſhould be but one ſubſtance, ſince every thing that is extended muſt neceſſarily have parts; and what has parts muſt be compounded. And, as the parts of extenſion do not ſubſiſt in each other, it follows, either that extenſion in the general is not ſubſtance, or that every part of extenſion is a different ſubſtance. Now, according to Spinoza, extenſion in general is an attribute of ſubſtance. And he allows, with other philoſophers, that the attributes of ſubſtance do not differ really from the ſubſtance itſelf. He muſt therefore allow, that extenſion in general is ſubſtance: whence it will follow, that every part of extenſion is a particular ſubſtance which overturns the whole ſyſtem.

If it be objected, that Spinoza does not conſider different bodies as different parts of extenſion, but as different modifications of it; the diſtinction between part and modification, we doubt, will hardly ſave him. For let him avoid the word part as much as he pleaſes, and ſubſtitute that of modality, or modification for it, the doctrine will amount to much the ſame: the characters of diverſity are not leſs real and evident, when matter is divided into modifications, than when it is divided into parts. The idea of the univerſe will ſtill be that of a compound being, or an aggregate of ſeveral ſubſtances.

For proof of this, it may be obſerved, that modalities are beings which cannot exiſt without the ſubſtance which modifies them; whence it follows, that the ſub-

ſtance

ſtance muſt be found where-ever its modalities are found; and even that the ſubſtance muſt be multiplied in proportion as the number of incompatible modifications is multiplied: ſo that, where-ever there are five or ſix of theſe modifications, there muſt be five or ſix ſubſtances. It is evident, that a ſquare figure and a circular figure are incompatible in the ſame piece of wax. Whence it follows, that the ſubſtance modified by the ſquare figure cannot be the ſame ſubſtance with that modified by the round figure. So, when I ſee a round and a ſquare table in a room, I may ſafely aſſert, that the extenſion which makes the ſubject of the round table is a diſtinct ſubſtance from the extenſion which is the ſubject of the ſquare table: ſince otherwiſe it would follow, that the ſquare and round figures might be found in the ſame ſubject at the ſame time.—The ſubject, therefore, that is modified by two figures, muſt be two ſubſtances.

2. If it be abſurd to make God extended, as this robs him of his ſimplicity, and makes him be compoſed of parts; it is ſtill worſe to reduce him to the condition of matter, the loweſt of all beings, and that which moſt of the ancient philoſophers ranked immediately above nothing: matter! the theatre of all ſorts of changes, the field of battle of contrary cauſes, the ſubject of all corruptions and generations; in a word, the being moſt incompatible with the immutability of the Deity!

The Spinoſiſts, indeed, maintain, that it is not ſuſceptible of any diviſion; but the argument they alledge, in proof of it, we have elſewhere ſhewn to be falſe: it is, that for matter to be divided, it is neceſſary that one of the parts be ſeparated from the other by a void ſpace, which is impoſſible: ſince there is no vacuum in nature.

3. If Spinoſiſm appear extravagant, when we conſider God as the ſubject of all the mutations, corruptions, and generations in bodies; it will be found ſtill worſe, when we conſider him as the ſubject of all the modifications of thinking. It is no ſmall difficulty to unite extenſion and thinking in the ſame ſubſtance; ſince it is not an union like that of two metals, or of water and wine, that will ſerve the purpoſe: theſe laſt require only juxta-poſition; whereas to combine thinking and extenſion requires an identity; thinking and extended are two attributes identified with the ſubſtance; and conſequently are indentified with each other, by the fundamental rule of all logic.

Again, when we ſay, that a man denies this, affirms that, likes that, &c. we make all thoſe attributes fall on the ſubſtance of his mind, not on his thoughts, which are only accidents or modifications of it. If therefore what Spinoza advances be true, that men are modalities of God; it would be falſe to ſay, 'Peter denies, likes, wills,' &c. ſince, in reality, on this ſyſtem, it is God that denies, wills, &c. and conſequently all the denominations which ariſe from the thoughts, deſires, &c. of men, fall properly and phyſically on the ſubſtance of God. From whence it alſo follows, that God affirms and denies, loves and hates, wills and not wills the ſame thing, at the ſame time, and under the ſame conditions, contrary to the great principle of reaſoning: '*Oppoſita ſunt quæ & neq; de ſe invicem, neq; de eodem tertio ſecundum idem, ad idem, eodem modo atq; tempore verè affirmari poſſunt*;' which muſt be falſe, if Spinoſiſm be true: ſince it cannot be denied but ſome men love and affirm what others hate and deny, under all the conditions expreſſed in the rules.

4. But, if it be phyſically abſurd to ſay the ſame ſubject is modified at the ſame time with all the different thoughts of all men, it is horrible when we conſider it in a moral light. Since it will follow, that the infinite, the all-perfect Being is not conſtant, is not the ſame one moment, but is eternally poſſeſſed even with contrary paſſions; all the uniformity in him, in this reſpect, will be, that for one good and wiſe thought he will have twenty fooliſh and wicked ones. He will not only be the efficient cauſe of all the errors, iniquities, and impurities of men, but alſo the paſſive ſubject of them, the *ſubjectum inhæſionis*. He muſt be united with them in the cloſeſt manner that can be conceived, even by a penetrative union, or rather an identity, ſince the mode is not really diſtinct from the ſubſtance modified.

Several have undertaken to refute Spinoza's doctrine, particularly the learned Dr. Clarke; we have alſo an examination of Spinoſiſm, and Mr. Bayle's objections againſt this ſyſtem, by Monſ. de Jariges, in the Mem. de l' Acad. de Berlin. Wolfius has alſo given a refutation of Spinoza, in his Theol. Nat. Part 2.

SPIRAL, in geometry, a curve line of the circular kind, which, in its progreſs, recedes from its center.

A ſpiral, according to Archimedes, its inventor, is thus generated; if a right line, as A B (plate CXXII. *fig.* 6.) having one end fixed at B, be equally moved round, ſo as with the other end A to deſcribe the periphery of a circle; and, at the ſame time, a point be conceived to move forward equally from B towards A, in the right line B A, ſo as that the point deſcribes that line, while the line generates the circle; then will the point, with its two motions, deſcribe the curve-line B 1, 2, 3, 4, 5, &c. which is called the helix or ſpiral line, and the plane ſpace, contained between the ſpiral line and the right line B A, is called the ſpiral ſpace.

If alſo you conceive the point B to move twice as ſlow as the line A B, ſo as that it ſhall get but half way along the line B A, when that line ſhall have formed the circle; and if then you imagine a new revolution to be made of the line carrying the point, ſo that they ſhall end their motion at laſt together, there will be formed a double ſpiral line, and the two ſpiral ſpaces, as you ſee in the figure.

From the geneſis of this curve, the following corollaries may be eaſily drawn. 1. The lines B 12, B 11, B 10, &c. making equal angles with the firſt and ſecond ſpiral, as alſo B 12, B 10, B 8, &c. are in arithmetical proportion. 2. The lines B 7, B 10, &c. drawn any how to the firſt ſpiral, are to one another as the arches of the circle intercepted betwixt B A and thoſe lines. 3. Any lines drawn from B to the ſecond ſpiral, as B 18, B 22, &c. are to each other as the aforeſaid arches, together with the whole periphery added on both ſides. 4. The firſt ſpiral ſpace is to the firſt circle as 1 to 3. And, 5. The firſt ſpiral line is equal to half the periphery of the firſt circle; for the radii of the ſectors, and conſequently the arches, are in a ſimple arithmetic progreſſion, while the periphery of the circle contains as many arches equal to the greateſt; wherefore the periphery to all thoſe arches is to the ſpiral lines as 2 to 1.

SPIRAL, in architecture and ſculpture, implies a curve that aſcends, winding about a cone or ſpire, ſo as all the points thereof continually approach the axis.
It is diſtinguiſhed from the helix by its winding around a cone; whereas the helix winds in the ſame manner around a cylinder.

Proportional SPIRALS, are ſuch ſpiral lines as the rhumb lines on the terreſtrial globe, which, becauſe they make equal angles with every meridian, muſt alſo make equal angles with the meridians in the ſtereographic projection on the plane of the equator; and therefore will be, as Dr. Halley obſerves, proportional ſpirals about the polar point.

SPIRE, *Spira*, in architecture, was uſed by the ancients for the baſe of a column, and ſometimes for the aſtragal or tore. But, among the moderns, it denotes a ſteeple that continually diminiſhes as it aſcends, whether conically or pyramidally.

SPIRIT, *Spiritus*, in metaphyſics, an incorporeal being or intelligence; in which ſenſe, God is ſaid to be a ſpirit, as are angels and the human ſoul.

The word ſpirit is, indeed, uſed in general to denote all thinking intelligent ſubſtances; but it would be the height of folly to imagine, becauſe this name is applied to the Creator as well as to the human ſoul, that therefore they partake of one common nature, and differ only as different modifications of the ſame ſubſtance: wherefore, when we call God a ſpirit, we ought by no means raſhly to preſume, that he is ſo in the ſame ſenſe in which the human ſoul is a ſpirit.

However, though we readily own there may be various ranks of ſpiritual beings; yet as we have no conceptions of the powers and operations of intellectual natures diſtinct from thoſe of our own minds, we are neceſſitated to conceive of them in a manner ſuited to our knowledge; and when we would rank them into ſpecies, according to the degrees of ſuperiority they are imagined in the ſcale of being, we aſcribe to them what we find moſt excel-

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lent in ourſelves, as knowledge, thinking, foreſight, &c. and thoſe in different meaſures, proportioned to the ſtation peculiar to each rank. But that this is a very imperfect way of diſtinguiſhing the various orders of intellectual beings, needs not many words to make appear; eſpecially if we conſider, that the manner of communicating their thoughts without the intervention of bodily organs, is a thing to us altogether incomprehenſible; which neceſſarily leads us to ſuppoſe, that they have ways of perception and knowledge, whereof our faculties cannot give us any notice.

SPIRITS, or ANIMAL SPIRITS, in phyſiology. See ANIMAL SPIRITS.

Our perceptions and actions are ſuppoſed to depend on the facility with which theſe ſpirits paſs from the brain to the nerves, and back from the nerves to the brain: for if the brain, the cerebellum, or the ſpinal marrow is hurt, there happens in all the parts where the nerves are diſtributed, which proceed from the diſordered part, convulſions and palſies; and if any nerve is tied or cut, the parts below the ligature loſe their ſenſe and motion, while thoſe above continue in their former ſtate.

SPIRIT, in chemiſtry, a name applied to ſeveral very different ſubſtances; however, in general, it denotes any diſtilled volatile liquor that is not inſipid, as phlegm, or pure water, nor inflammable as oil: but under this general idea are comprehended liquors of quite oppoſite natures, ſome being acid, and others alkaline; which laſt are ſuch enemies to the former, that as ſoon as they are put together they raiſe a violent effervеſcence, and grow hot; and to theſe may be added a third ſort, called vinous or inflammable ſpirits; which though very ſubtile and penetrating, are not manifeſtly either acid or alkaline.

All theſe ſorts of ſpirits Mr. Boyle ſhews to be producible: and, 1. The vinous, which nature ſcarce ever produces of herſelf, are the creatures of vinous fermentation, or are actually produced, though not ſeparated, in that operation.

2. The alkaline or volatile ſpirits, called alſo the urinous, by reaſon of their affinity in many qualities with ſpirit of urine, are manifeſtly not ſimple but compound bodies: conſiſting of the volatile ſalt of the reſpective concretes diſſolved in the phlegm, and for the moſt part accompanied with a little oil: ſo that theſe may be referred to the claſs of volatile ſalts.

3. Acid ſpirits appear to be producible, becauſe thoſe drawn from common ſalt and nitre are very different in reſpect of taſte, &c. from the bodies they are procured from, which are not properly acid: ſo that it does not appear that theſe ſpirits pre-exiſted in that ſtate of thoſe bodies.

What farther confirms this doctrine of ſpirits is, that the ſame body, merely by different ways of ordering it, may be brought to afford either acid, vinous, or urinous ſpirits; add, that whereas ſalt is accounted the principle of all taſte, it follows that ſpirits, being ſapid, muſt contain ſalt; ſince it is taſte that characterizes and diſtinguiſhes it from phlegm, and denominates it acid, vinous, or urinous ſpirit.

Spirits, diſtilled from fermented liquors, conſiſt of very different ingredients, viz. a pure ſpirit or alcohol, phlegm, a certain acetous fermented acid, and a ſmall quantity of ill ſcented oil; ſo that it becomes neceſſary, in order to obtain the ſpirit perfectly pure, to re-diſtil it ſeveral times.

By reducing ſpirit, therefore, to the utmoſt degree of purity, an alcohol is obtained; which, as Dr. Shaw expreſſes it, is a liquor ſui generis, and poſſeſſed of many peculiar qualities; as, 1. When abſolutely purified, it is an uniform and homogene liquor, capable of no farther ſeparation, without loſs or deſtruction of ſome of its homogeneous parts. 2. It is totally inflammable, leaving no ſoot, nor any moiſture behind. 3. It has no peculiar taſte or flavour, any more than pure water, except what is owing to its nature as alcohol, or perfectly pure ſpirit. 4. It is an unctuous and criſpy fluid, running veiny in the diſtillation, and its drops rolling on the ſurface of any other fluid, like peaſe upon a table, before they unite. 5. It appears to be the eſſential oil of the body it is obtained from broken very fine, and intimately and ſtrongly mixed with an aqueous fluid, which is aſſimilated, or changed in its nature in the operation. 6. And laſtly, it ſeems to be a kind of univerſal fluid, producible with the ſame properties from every vegetable ſubject; but to produce it thus, requires ſome care in the operation.

On theſe principles is founded the opinion, that all ſpirits may be deduced to a perfect ſimilarity, or ſameneſs, from whatever ſubject they are produced, and on this depends their convertibility into one another; for when once they are brought to this ſtandard of ſimplicity, there needs nothing more than to add the oil of ſuch of the finer ſpirits as is required to convert the ſpirit into that particular kind. By this means the ſame taſteleſs ſpirit, whether obtained from malt, ſugar, or grapes, may be made into either malt ſpirit, brandy, or rum, by adding the eſſential oil of the grape, ſugar, or malt; and thus what was once malt ſpirit, ſhall become brandy, or whatever elſe the operator pleaſes.

Many methods have been attempted to obtain the firſt point, that is, the reducing the ſpirit to perfect and pure alcohol: the moſt practicable means ſeem to be long digeſtion, and the repeated diſtillation from water into water, where the eſſential oil will at once be left upon two ſurfaces, and the acid imbibed; the ſhorter ways, are thoſe by rectifying from neutral abſorbent ſalts and earths; ſuch are ſugar, chalk and the like; and, laſtly, the uſe of fixed alcalies may be tried, for theſe very forcibly keep down both the phlegm and oil; inſomuch that this laſt method promiſes to be the ſhorteſt of all, if the art were known of utterly aboliſhing the alkaline flavour, which the alcohol is apt to acquire.

For as vinous ſpirits ariſe with a leſs degree of heat than watery liquors, if due regard be had to this circumſtance, very weak ſpirits may, by one or two wary diſtillations, in a degree of heat leſs than that in which water boils, be tolerably well freed of their aqueous phlegm: and in order to free it from its foul oil, add to every gallon of it a pound or two of pure, dry, and fixed alkaline ſalt; which being digeſted together for ſome time, the alkali, from its known property of attracting water and oils, will imbibe the remaining phlegm, and ſuch part of the diſagreeable unctuous matter as may be ſtill left in the ſpirit, and ſink with them to the bottom of the veſſel. If the ſpirit be now again gently drawn over, it will ariſe entirely free from its phlegm and nauſeous flavour; but as ſome particles of the alkaline ſalt are apt to be carried up with it, and give it an urinous reliſh, a ſmall proportion of any fixed acid liquor, or rather of an acid ſalt, as vitriol or alum, ſhould be added to it.

The ſpirit obtained by this proceſs is called alcohol, and is extremely pure, limpid, perfectly flavourleſs, and fit for the fineſt purpoſes: it may be reduced to the ſtrength commonly underſtood by proof-ſpirit, by mixing twenty ounces of it by weight with ſeventeen ounces of water. The diſtilled cordials made with theſe ſpirits, are much more elegant and agreeable than when the common rectified or proof ſpirits of the ſhops are made uſe of.

There are many occaſions in which chemiſts, and other artificers, ſtand in need of the true and pureſt alcohol, the leaſt remainder of water rendering the operation unſucceſsful: hence it is abſolutely neceſſary we ſhould have ſome marks, by which to diſtinguiſh whether our alcohol be pure or not. The principal of theſe are, 1. If the ſuppoſed alcohol contains any oil diſſolved in it, and ſo equably diſtributed through it, that it is no ways perceptible, then upon pouring of water into it, the mixture will grow white, and the oil ſeparate from the alcohol. 2. If any thing of an acid lies concealed in the alcohol, a little of it mixed with the alkaline ſpirit of ſal ammoniac will diſcover the acid by an effervеſcence excited by the affuſion of the acid; for otherwiſe there would be only a ſimple coagulation. 3. If there be any thing of an alkali intermixed, it will appear by the effervеſcence excited by the affuſion of an acid. 4. But it is a matter of great difficulty to diſcover whether there be any water intermixed with it. The beſt method of doing this is the following: take a chemical veſſel with a long narrow neck, the bulb of which will hold four or ſix ounces of alcohol. Fill this two thirds full with the

the alcohol you intend to examine, into which throw a dram of the pureſt and drieſt ſalt of tartar, coming very hot out of the fire; then mix them by ſhaking them together, and ſet them over the fire till the alcohol is juſt ready to boil. Being thus ſhaken, and heated, if the ſalt of tartar remains perfectly dry, without the leaſt ſign of moiſture, we are ſure that there is no water in the alcohol. The learned Boerhaave tells us, that by this method he diſcovered water in alcohol which had been looked upon as pure, having undergone every other method of trial.

Medicinal Virtues of SPIRITS. The too free uſe of inflammable or vinous ſpirits, is attended with very bad effects; as the body is thereby greatly attenuated, the ſtrength impaired, and the brain ſtupified. However, as Dr. Pringle juſtly obſerves, we ought not to confound the neceſſary and moderate uſe of ſpirits with the vice of indulging in them to exceſs. So far, therefore, from thinking the moderate uſe of ſpirits detrimental to ſoldiers, and others, who are expoſed to the extremes of heat and cold, and to moiſt and bad air, he even recommends it; and as to ſoldiers in particular, he obſerves, that ſpirits, even when drank to exceſs, tend more to weaken the conſtitution than to produce any of the common camp-diſeaſes.

Hence, in eſtabliſhing meſſes among the ſoldiers, which he thinks would be attended with many good conſequences, he alſo recommends ſome regulations to be made with regard to an allowance of ſpirits, whether by ſtoppages on the pay or otherwiſe: this he enforces by obſerving, that the like practice already obtains in the navy, and probably for the ſame reaſons for which it would be proper in the army; ſince in ſhips, the men are alſo liable to diſtempers ariſing from moiſt and corrupted air. It is the abuſe, therefore, of vinous ſpirits that ought to be condemned; ſince, taken in moderation, they can do no harm; and if properly accommodated to circumſtances, may have very good effects.

Spirits are alſo of uſe, in external applications, to wounds and ſores; as they ſtimulate the fluids, reſiſt putrefaction, and quicken the pulſe when abſorbed. Tinctures of abſorbent and aromatic powders are often preſcribed with the ſame intention; by reaſon they partake of the nature of their ingredients, but principally of the ſpirit.

As to the volatile ſpirits, diſtilled from animal and other ſubſtances, they are in general extremely pungent and acrimonious; applied to the ſkin, and prevented from exhaling, they inflame the part, and produce the effect of cauſtics; they alſo liquefy the animal juices, and diſſolve the coagula made from them with acids; with which being mixed, they effervеſce, and unite into neutral ſalt. With regard to their medical virtues, they ſtimulate the nervous ſyſtem, attenuate viſcid humours, promote a diaphoreſis, and other natural ſecretions, and abſorb acidities in the primæ viæ: they are particularly uſeful in lethargic and apoplectic caſes, in hypochondriacal and hyſterical diſorders, and the languors, head-achs, inflatations of the ſtomach, flatulent colics, and other ſymptoms which attend them. However, they are generally found more ſerviceable in aged perſons, and in phlegmatic habits, than in the oppoſite circumſtances: in febrile and inflammatory diſtempers, they are hurtful, except in ſuch fevers as are accompanied with a cough, hoarſeneſs, and redundance of phlegm: they are moſt conveniently exhibited in a liquid form, largely diluted with water, or other convenient liquors; the doſe being from five or ſix to thirty or more drops.

The acid ſpirits drawn from foſſils, and applied to animal bodies, coagulate the fluids, and mortify the ſolids: by being diluted with water, they approach to the nature of vinegar. Metallic ſubſtances, diſſolved in theſe ſpirits, increaſe their corroding ſphacelating quality, ſo as ſometimes to occaſion convulſions.

SPIRITUAL, in general ſomething belonging to, or partaking of, the nature of ſpirit.

The ſpiritual courts, in law, are ſuch as have juriſdiction in matrimonial cauſes, and for probate of wills, and granting adminiſtration of goods; as alſo in regard to tythes, and in caſes of defamation, &c.

SPIRITUALITIES *of a Biſhop*, are the profits that he receives as a biſhop, and not as a baron of parliament; ſuch are the duties of his viſitation, preſentation-money, what ariſes from the ordination and inſtitution of prieſts, the income of his juriſdiction, &c.

SPLEEN, *Lien*, in anatomy, a ſoft ſpungy viſcus, ſituated in the left hypochondrium, under the diaphragma between the ribs and the ſtomach, above the left kidney. It is tied to the peritonæum, to the midriff, and to the omentum: it is of a bluiſh or leaden colour, of an oblong figure, thick at the edges, and not thin at the liver. It has two membranes. The external comes from the peritonæum. The internal membrane is finer and thinner than the external: for, if you blow into the ſplenic artery, the air ſhall paſs through the one, but not the other. Its fibres are not irregularly woven, as thoſe of the other membranes ſeem to be; but they come from innumerable points, as rays from ſo many centers, and the fibres of one point are regularly woven with the fibres of the point ſurrounding it. It receives veins, nerves, and arteries, from thoſe that enter the ſpleen. The ſubſtance of the ſpleen is not only kept together by its two membranes, but alſo by innumerable fibres which come from the points of the internal membrane, and are inſerted in the points of the oppoſite ſide of the ſame membrane: the expanſion of the extremity of theſe fibres ſeems to compoſe the internal membrane. The ſpleen is compoſed of an infinity of membranes, which form little cells and cavities of different figures and bigneſs, which communicate with one another, and which are always full of blood. At the extremities of the blood-veſſels in the ſpleens of ſheep, we find ſeveral ſmall, white, and ſoft ſpecks, which Malpighi calls glands. The ſpleen has arteries from the cœliac, whoſe capillary branches make frequent inoſculations upon the membranes of the cells. Its veins, whoſe extremities communicate with the cavities of the cells, as they come out of the ſpleen, unite, and make the ramus ſplenicus of the vena portæ, which carries the blood from the ſpleen to the liver. Theſe, with its nerves, which are conſiderable from the plexus ſplenicus, are equally diſtributed through the whole ſubſtance of the ſpleen, being all included in a common capſula. There are likewiſe a few lymphatic veſſels which ariſe from the ſpleen, and diſcharge them into the lumbary glands.

The ſpleen, being always full of a dark-coloured blood, was by the ancients thought to be the receptacle of the atra bilis, a humour no where to be found. And all that has been ſaid about its uſe by the moderns, has been to little ſatisfaction, till Dr. Keill taught us thus to reaſon thereupon.

We muſt conſider that the bile is compoſed of particles, which ſlowly combine and unite together, and that by reaſon of the vicinity of the liver to the heart, and of the ſwift motion of the blood through the aorta, theſe particles could not in ſo ſmall a time, and with ſo great a velocity, have been united together, had not the blood been brought through the coats of the ſtomach, inteſtines, and omentum, by the branches of the vena portæ, to the liver. But, becauſe all theſe parts were not ſufficient to receive all the blood which was neceſſary to be ſent to the liver, therefore nature framed the ſpleen, into whoſe cavities the blood being poured from a ſmall artery, moves at leaſt as ſlowly as any that paſſes otherwiſe to the liver; by which means the particles which compoſe the bile in the blood which paſſes through the ramus ſplenicus, by a long and ſlow circulation, have more chances for uniting them, which otherwiſe they could not have had, had they been carried by the branches of the cœliac artery directly to the liver; and conſequently without the ſpleen, ſuch a quantity of bile as is now ſecerned, that is, as nature requires, could not have been ſecerned by the liver. And this he takes to be the true uſe of the ſpleen.

SPLEEN is alſo uſed for a diſeaſe by phyſicians more uſually called the hypochondriac diſeaſe.

SPLENETIC, a perſon affected with oppilations and obſtructions of the ſpleen. In ſplenetic people, the ſpleen is ſwelled beyond the natural bulk, or hardened ſo as to ſhew a ſerous tumour thereon.

SPLENETIC VESSEL, a large artery and vein of the ſpleen.

SPLENIUS, in anatomy, a pair of the extenſor muſcles of the head, which riſing from the lower vertebra of the neck, and the five upper ones of the back, is inſerted a little above the maſtoide proceſs.

SPLENT, or SPLINT, among farriers, a callous, inſenſible excreſcence, breeding on the ſhank-bone of horſes; which, when it grows big, ſpoils the ſhape of the leg, and generally comes upon the inſide: but if there be one oppoſite to it on the outſide, it is called a peg, or pinned ſplent; becauſe it does, as it were, pierce the bone, and is extremely dangerous.

The ſimple ſplents are only faſtened to the bone, at a pretty diſtance from the knee, and without touching the back ſinew, and have not a very bad conſequence; but thoſe that touch the back ſinew, or are ſpread on the knee, will make a horſe lame in a ſhort time.

For the cure of this malady, ſhave away the hair, and rub and beat the ſwelling with the handle of a ſhoeing hammer; then having burnt three or four hazle-ſticks, while the ſap is in them, chafe the ſplent with the juice, or water that iſſues out at both ends, applying it as hot as you can, without ſcalding the part: after that, rub or bruiſe the ſwelling with one of the ſticks, and continue frequently to throw the hot juice upon the part, but ſo as not to ſcald it, and continue ſtill rubbing it, till it grows ſoft. Then dip a linnen cloth, five or ſix times double, in the hazle-juice, as hot as your hands can endure it, and tie it upon the ſplent, where let it remain for twenty-four hours, keeping the horſe in the ſtable for the ſpace of nine days, not ſuffering him to be either ridden or led to water; by which time, the ſplent will be diſſolved, and the hair will afterwards grow on it again.

SPLENTS, or SPLINTS, in ſurgery, pieces of wood, uſed in binding up broken limbs.

SPLINTER, a ſmall ſhiver of wood, or the like. The ſplinters of fractured bones, if looſe, are to be carefully removed, otherwiſe replaced.

SPODIUM, in pharmacy, one of the fouleſt recrements of copper; being nothing but the worſt and heavieſt parts of the cadmia oſtracitis, thrown up in ſuch coarſe pieces by the blaſt of the bellows, that it does not adhere to the roof or ſides of the furnace, but falls down again into ſeveral parts of the furnace; and being collected along with many other kinds of foulneſſes, in form of a blackiſh heavy matter, is indeed no better than the ſweepings of the furnaces, where the copper is refined.

SPOILS, *Spolia*, whatever is taken from the enemy, in time of war.

Among the ancient Greeks, the ſpoils were divided in common among the whole army, only the general's ſhare was largeſt; but among the Romans, the ſpoils belonged to the Republic.

SPONDEE, in the Greek and Latin proſody, a foot of verſe conſiſting of two long ſyllables:— as *vērtūnt*.

SPONDYLUS, in anatomy, a name anciently given to a vertebra of the ſpina dorſi.

SPONGIA, *Spunge*, in botany, &c. See the article SPUNGE.

SPONGIOSA, in anatomy, an epithet given to ſeveral parts of the body by reaſon of this texture, which is porous and cavernous, like that of a ſpunge.

SPONSORS, among Chriſtians, are thoſe perſons, who, in the office of baptiſm, anſwer, or are ſureties, for the perſons baptiſed.

In the ancient church, there were three ſorts of ſponſors: 1. For children, who could not anſwer for themſelves; and in moſt caſes, parents were ſponſors for their own children. 2. For ſuch perſons as, by reaſon of ſickneſs or infirmity, were in the ſame condition with children; who might be baptized, if their friends teſtified, that they had before-hand deſired baptiſm, and at the ſame time became their ſponſors. 3. For all adult perſons in general; for theſe too had their ſponſors, as no perſons were baptiſed without them.

It is obſervable, that anciently no more than one ſponſor was required, namely, a man for a man, and a woman for a woman: however, in the caſe of infants, no regard was had to the difference of ſex; for a virgin might be ſponſor for a male child; and a father for his children, whether male or female.

In the modern Chriſtian church, the office of ſponſors, or ſureties in baptiſm, is better known than practiſed; we call them god-fathers and god-mothers.

SPONTANEOUS, in the ſchools, is a term applied to ſuch motions of the body and mind as we perform of ourſelves, without conſtraint.

The word is formed from the Latin adverb *ſponte*, of one's own accord.

SPORADES, among antient aſtronomers, a name given to ſuch ſtars as were not included in any conſtellation.

SPORADIC, is uſed for ſuch diſeaſes as reign in the ſame place and time.

SPOTS, in aſtronomy, certain places of the ſun's or moon's diſc, obſerved to be either more bright, or darker, than the reſt, and accordingly, called faculæ and maculæ.

SPOUT, or WATER-SPOUT, in natural hiſtory, an extraordinary and dangerous meteor, obſerved at ſea, and ſometimes at land, called by the Latins, *typho* and *ſipho*. Its firſt appearance is in form of a deep cloud, the upper part of which is white, and the lower black: then from the lower part of this cloud hangs, or rather falls down, what is properly called the ſpout, in form of a conical tube, biggeſt at top; and under this tube there is always a great boiling and flying up of the water of the ſea, as in a *jet d'eau*. For ſome yards above the ſurface of the ſea, the water ſtands as a column or pillar, from the extremity of which it ſpreads and goes off, as in a kind of ſmoke. Frequently, the cone deſcends ſo low, as to touch the middle of this column, and continue for ſome time contiguous to it; though ſometimes it only points to it, at ſome diſtance, either in a perpendicular or oblique line. Frequently it is ſcarce diſtinguiſhable, whether the cone or the column appear the firſt, both appearing all of a ſudden againſt each other. But ſometimes the water boils up from the ſea to a great height, without any appearance of a ſpout pointing to it, either perpendicularly or obliquely. Indeed, generally, the boiling or flying up of the water has the priority, this always preceding its being formed into a column. Generally, the cone does not appear hollow, till towards the end, when the ſea-water is violently thrown up along its middle, as ſmoke up a chimney. Soon after this, the ſpout or canal breaks and diſappears; the boiling up of the water, and even the pillar, continuing to the laſt, and for ſome time afterwards; ſometimes till the ſpout form itſelf again, and appear a-new; which it ſometimes does ſeveral times in a quarter of an hour. See plate CXXII. *fig.* 7.

M. de la Pyme, from a near obſervation of two or three ſpouts in Yorkſhire, deſcribed in the Philoſophical Tranſactions, gathers that the water-ſpout is nothing but a gyration of clouds by contrary winds, meeting in a point or center; and there, where the greateſt condenſation and gravitation is, falling down into a pipe or great tube, ſomewhat like Archimedes's ſpiral ſcrew; and, in its working and whirling motion, abſorbing and raiſing the water, in the ſame manner as the ſpiral ſcrew does; and thus deſtroying ſhips, &c. Thus, June the 21ſt, he obſerved the clouds mightily agitated above and driven together; upon which they became very black, and were hurried round, whence proceeded a moſt audible whirling noiſe, like that ordinarily heard in a mill. Soon after, iſſued a long tube or ſpout, from the center of the congregated clouds, wherein he obſerved a ſpiral motion like that of a ſcrew; by which the water was raiſed up. Again, Auguſt 15, 1687, the wind blowing at the ſame time out of ſeveral quarters, created a great vortex and whirling among the clouds; the center whereof, every now and then, dropped down, in ſhape of a long, thin, black pipe, wherein he could diſtinctly behold a motion like that of a ſcrew, continually drawing upwards, and ſcrewing up, as it were, wherever it touched. In its progreſs it moved ſlowly over a grove of trees, which bent under it like wands in a circular motion.

Fig. 1. Sound.

A.				
B.	A		A	B
C.	B C	A	B	C
D.	D	B	C	D
E.	E	C		
F.	F	D E	D	E
G.	G	F G	E	F
H.	H		F	G
I.	K		G	H
K.	L	H		
L.	M	I K		I
M.	N	L M		K
O.		N		L
P.		O P		M
Q.		Q		N
R.		R		O
S.		S		P
T				Q R S T
V.				V
W.				W X
				Y

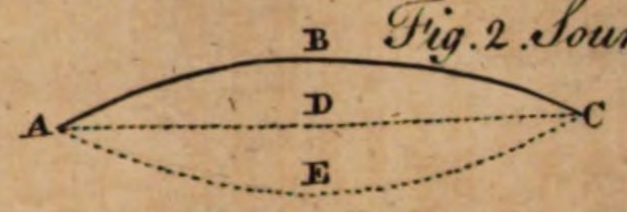

Fig. 2. Sound.

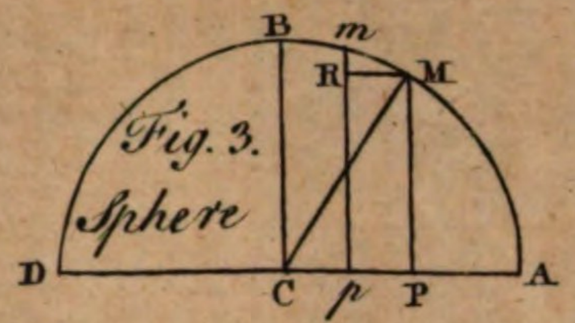

Fig. 3. Sphere

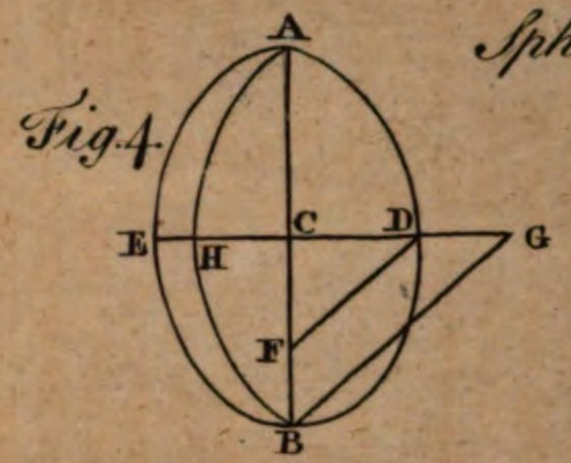

Fig. 4. Spheroids.

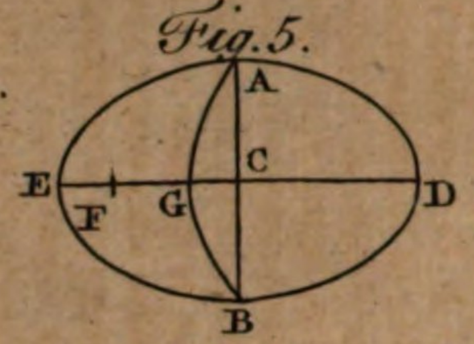

Fig. 5.

Fig. 7. Spout.

Fig. 6. Spiral.

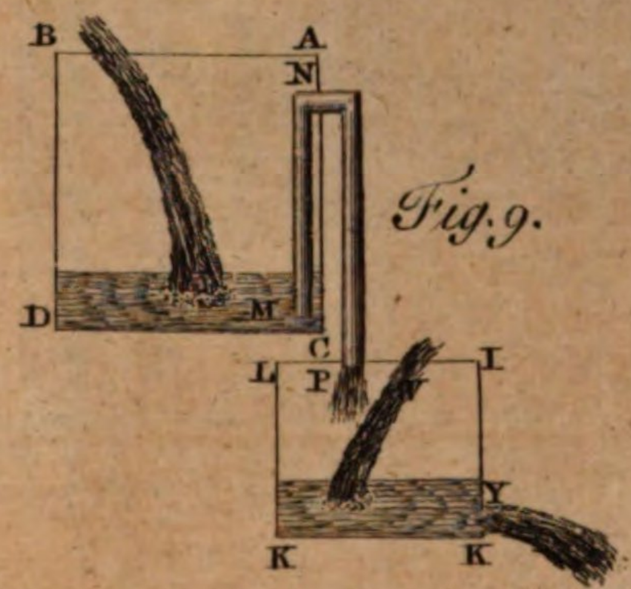

Fig. 9.

Fig. 8. Spring.

Fig. 10. Well.

tion. Proceeding it tore off the thatch from a barn, bent a huge oak-tree, broke one of its greateſt branches, and threw it to a great diſtance. He adds, that, whereas it is commonly ſaid, the water works and riſes in a column, before the tube comes to touch it; this is doubtleſs a miſtake, owing to the fineneſs and tranſparency of the tubes, which do moſt certainly touch the ſurface of the ſea, before any conſiderable motion can be raiſed therein; but which do not become opake and viſible, till after they have imbibed a conſiderable quantity of water.

The diſſolution of water-ſpouts he aſcribes to the great quantity of water they have glutted; which by its weight impeding their motion, whereon their force, and even exiſtence, depends, they break and let go their contents; which uſe to prove fatal to whatever is found underneath. A notable inſtance hereof we have in the Philoſophical Tranſactions, related by Dr. Richardſon; for a ſpout in 1718 breaking on Emott-moor, nigh Coln, in Lancaſhire, the country was immediately overflowed.

In Pliny's time, the ſeamen uſed to pour vinegar into the ſea, to aſſuage and lay the ſpout, when it approached them: our modern ſeamen keep it off, by making a noiſe with filing and ſcratching violently on the deck, or by diſcharging great guns to diſperſe it.

SPRING, *Fons*, in natural hiſtory, a fountain or ſource of water ariſing out of the ground.

The origin of ſprings, or fountains, is a thing greatly controverted among naturaliſts. There are however but three hypotheſes of any tolerable repute relating to this queſtion: all others, it is allowed by every philoſopher, are not worth mentioning, much leſs the trouble of confuting.

The firſt hypotheſis is that of Des Cartes, who was of opinion, that the water of the ſea diffuſed itſelf in all directions under ground, and that, coming to the bottom of mountains, it there met with large caverns, into which, being rarified by the central heat beneath, it aſcended in vapours, leaving its ſaline parts behind, as being ſuperficially heavier; that theſe vapours, being impeded in their aſcent by the tops of the caverns, condenſed there, forming little ſtreams of currents of water, like the ſteam in the head of an alembic.

But this hypotheſis is far from being agreeable to truth; for, in the firſt place, it is begging the queſtion to ſuppoſe any ſuch free paſſages of communication betwixt the ſea and the baſes of mountains; nor can any experiment be produced to warrant the ſuppoſition of theſe ſubterraneous channels; on the contrary, whereever running waters have been diſcovered in the bowels of the earth, it has been obſerved, that they run the contrary way, viz. from the mountains to the ſea.

But let us grant that the waters have a free paſſage from the ſea, for two or three hundred leagues, to the baſes of high mountains; where are the furnaces which remain in ſuch a conſtant ſtate of readineſs and heat, to rarify theſe waters, and make them evaporate in clouds? But let us ſtill farther allow, that there is a ſufficient degree of heat for this purpoſe; yet where are thoſe caverns ſix or ſeven hundred paces high, whoſe cool vaults are to condenſe theſe exhaled vapours? It is certain that people have digged and penetrated far enough into the bowels of the earth and mountains, to make the diſcovery, but without ever finding caverns big enough to allow the vapours a free aſcent to the height of the fountains, from whence the rivers derive their ſource. Beſides, a concurrence of all theſe vapours could not produce the leaſt ſtream of freſh water; for the vapours adhering to the ſide of the caverns, and there condenſing, not finding any receptacle to receive them, and from whence they might iſſue out through the ſides in ſprings, muſt conſequently fall down again into the baſon from whence they aroſe: ſo that theſe wonderful alembics, with which Des Cartes ſeems ſo highly delighted, are only mere fancies, having no exiſtence in nature.

The ſecond hypotheſis ſuppoſes that the ſea-water percolates through the pores of the earth, which, though large enough for the fluid to penetrate, yet are ſo ſmall as to deny admittance to the ſaline particles which are commixed with them; which the water, during the courſe of its filtration, leaves behind, thus refining and purifying itſelf, till it becomes freſh and potable, before it mixes with the fountains and rivers.

But this hypotheſis is no leſs abſurd than the former; for, what can become of the ſalt which ſo many rivers muſt have depoſited under ground? It is now about ſix thouſand years that the ſea, according to this hypotheſis, has been diſtributing out its waters and ſalts to the ſource of rivers, without having received in return from them any other than freſh water; and conſequently it would have happened, by degrees, either that the ſea muſt have emptied itſelf of all its ſalts, or the earth have been ſo overcharged with them, as that theſe ſalts would have blocked up thoſe ſubterraneous channels the water ſhould paſs through, in order to ſupply the fountains.

It has been found by repeated experiments, that a pound of ſalt-water will yield four drams of ſalt, and conſequently a cubic foot of water, which weighs near ſeventy pounds, will produce three pounds of ſalt; but, that our calculation may be allowed moderate and unexceptionable, we will ſay only two pounds. Now the celebrated Dr. Halley, by an unexceptionable calculation, found that the quantity of water which paſſes daily thro' the Thames, is above 76,032,000 cubic feet; and conſequently the quantity of ſalt daily depoſited in the bowels of the earth, before it arrives to the ſources of that river, muſt be 152,064,000 pounds, or above 678, 857 tons. We have hitherto taken out but one river into our account; but, if we add thoſe of the whole earth, what prodigious quantities of ſalt muſt be daily amaſſed in the bowels of the earth! A few years will be ſufficient to render thoſe maſſes bigger than the mountains themſelves, and the earth muſt conſtantly increaſe and ſwell with theſe additional ſupplies of matter.

The third hypotheſis owes its origin to that ſagacious naturaliſt, Dr. Edmund Halley, and is as follows: It is evident from experience, that there perpetually ariſes a vapour from the ſurface of the ſea, rivers, and lakes; this vapour is carried through the atmoſphere in the form of a cloud or miſt, by the impulſe of winds; and, according as it meets with a colder air, or is ſtopped in its progreſs by mountains, it condenſes, and falls down in dew, ſnow, or rain; the water, in whichſoever of theſe ſhapes it deſcends, finds ſeveral chinks and crannies, through which it inſinuates itſelf into the main body of the hills or mountains, where it is lodged in beds of ſtone or clay, according to the nature of the ſoil; and by degrees, increaſing its ſtore and ſtrength, it forces its way through the firſt outlet it meets with, and takes the name of a temporal or perrenial fountain, according to the capacity of the baſon, which ſupplies its current.

This beautiful hypotheſis, which has been received with univerſal applauſe and ſatisfaction by the learned world, we ſhall endeavour to demonſtrate, by the two following propoſitions: 1. That the vapours which ariſe from the ſea, are much more than ſufficient to ſupply both the ſurface of the earth and the rivers with water. 2. That the mountains do, by their particular ſtructure and formation, attract, and, as it were, arreſt the vapours and the rain that fluctuate about in the atmoſphere: and, having collected them in their reſervoirs, diſmiſs them again through their ſides, either in perpetual or intermitting currents.

With regard to the firſt, the ingenious author of this theory made the following experiment: he took a veſſel of water, and made of the ſame degree of ſaltneſs with that of the ſea, by means of the hydrometer; and having placed a thermometer in it, he brought it, by means of a pan of coals, to the ſame degree of heat with that of the air in the hotteſt ſummer. He then placed this veſſel with the thermometer in it, in one ſcale, and nicely counterpoiſed it with weights in the other; after two hours, he found, that about the ſixtieth part of an inch was gone off in vapour, and conſequently in twelve hours, the length of a natural day, one tenth of an inch would have been evaporated.

From this experiment it follows, that every ten ſquare inches of the ſurface of the water yield a cubic inch of water in vapour per day, every ſquare mile 6914 tons, and every ſquare degree (or 69 Engliſh miles) 33 millions of tons. Now, if we ſuppoſe the Mediterranean

to be 40 degrees long, and 4 broad, at a medium, which is the leaſt that can be ſuppoſed, its ſurface will be 160 ſquare degrees, from whence there will evaporate 5280 millions of tons per day, in the ſummer-time.

The Mediterranean receives water from the nine great rivers following, viz. the Iberus, the Rhine, the Tyber, the Po, the Danube, the Neiſter, the Boryſthenes, the Tanais, and the Nile; all the reſt being ſmall, and their water inconſiderable. Now let us ſuppoſe that each of theſe rivers conveys ten times as much water to the ſea as the Thames; which, as is obſerved, yields daily 76,032,000 cubic feet, which is equal to 203 millions of tons; and therefore all the nine rivers will produce 1827 millions of tons; which is little more than one third of the quantity evaporated each day from the ſea. The prodigious quantity of water remaining, the doctor allows to rains, which fall again into the ſeas, and for the uſes of vegetation, &c.

As to the manner in which theſe waters are collected, ſo as to form reſervoirs for the different kinds of ſprings, it ſeems to be this: the tops of mountains, in general, abound with cavities, and ſubterraneous caverns formed by nature to ſerve as reſervoirs; and their pointed ſummits, which ſeem to pierce the clouds, ſtop thoſe vapours which fluctuate in the atmoſphere, and being conſtipated thereby, they precipitate in water, and by their gravity eaſily penetrate through beds of ſand and lighter earth, till they are ſtopped in their deſcent by more denſe ſtrata, as beds of clay, ſtone, &c. where they form a baſon or cavern, and work a paſſage horizontally, and iſſue out at the ſide of the mountain.

Many of theſe ſprings running down by the vallies, between the ridges of hills, and uniting their ſtreams, form rivulets or brooks; and many of theſe again, uniting on the plain, become a river.

In order to account for the different ſorts of ſprings, let A B C D E (plate CXXII. *fig.* 8.) repreſent the declivity of a hill, whoſe ſection, from top to bottom, is ſhewn in the figure; in which let F G H be a cavern or baſon near the top, which collects the water gleeting through the ſtrata, and has a drain or duct leading to the ſide of the hill at B. It is evident, that, when the water ariſes to the drain H, it will deſcend through it to B, where it will break out in form of a fountain or ſpring, and will continue running while the reſervoir is ſupplied with water above the level F H, and after that it will become dry. Hence we ſee that a ſpring may be formed near the tops of the higheſt mountains and hills; but on the very tops, it is impoſſible for them to be generated.

Intermitting ſprings, or thoſe which flow and ſtop by regular alterations and intermiſſions, may be thus accounted for: let I K L repreſent a cavity in the mountain, to which, at I, there is a feeding ſtream which brings the water from other parts: and at K, on the lower part, there goes a duct K *k* C, of a curved or crooked form, which conveys the water to the ſide of a hill at C, where it breaks out into a ſpring. Now, it is evident, that, as the water riſes in the cavern, it will alſo riſe in the duct, till the ſurface of the water I L be level with the higheſt part *k* of the duct, and then the water will deſcend from *k* to C, which point, being lower than the orifice of the duct at K, will exhauſt the cavern of all its water, and the ſpring will ſtop, till the ciſtern is repleniſhed to the ſame level I L, by the feeding ſtream I, and then the fountain will play again. An artificial fountain of this kind may be alſo eaſily made.

Reciprocating SPRINGS, or thoſe which flow and ebb alternately, are occaſioned in the following manner. Let A B C D (*fig.* 9.) repreſent a reſervoir, fed by the ſtream O, whoſe water flows into another reſervoir I K L, through the ſyphon M N, and at the ſame time has another ſtream at W, falling into the ſame reſervoir, whoſe outlet or ſpring is at Y. This ſpring will reciprocate, or flow and ebb; for, when the ſyphon M N works, the ſurface of the water at Y will be ſuddenly raiſed, and preſs upon the water at K, with a greater force, and conſequently it will iſſue out with a greater velocity, and raiſe the ſurface, if confined; but, when the ſyphon intermits, the momentum will be leſs, and then the ſtream will ebb or decreaſe. This may alſo be underſtood from *fig.* 10. where M N O repreſents the reſervoir, which is fed both by the ſtream M, and alſo by that at O, when the ſpring at C works, and D the out-let or fountain; for when the ſpring at C works, the ſpring at D will flow or increaſe; but, when that at C intermits, the other at D will ebb.

Medicinal Virtues, &c. *of* SPRINGS. Theſe are owing to the different qualities and temperament of the ſtrata through which theſe waters may be collected, or paſs: if thoſe reſervoirs of water in the body of mountains be ſituated where mineral ores abound, or the ducts and feeding ſtreams run through mineral earths, it is eaſy to conceive that particles of metal will mix with, and be abſorbed by the water, which being ſaturated therewith, becomes a mineral ſpring or well. If ſalt, ſulphur, lime-ſtone, &c. abounds in the ſtrata, through which the water paſſes, it will then be ſaline, ſulphureous, lime-water, &c. If ſulphur and iron ſhould both abound in the parts of the hill, whence the waters come, the waters will partake of the warmth or heat which is occaſioned by the mixture of two ſuch ſubſtances in the earth, where they are found.

SPRING, *Ver*, in coſmography, implies one of the ſeaſons of the year; commencing, in the northern parts of the world, on the day the ſun enters the firſt degree of Aries, which is about the twenty-firſt of March, and ending when the ſun leaves Gemini.

SPRING, *Elator*, in mechanics, denotes a thin piece of tempered ſteel, or other elaſtic ſubſtance; which, being wound up, ſerves to put ſeveral machines in motion by its elaſticity, or endeavour to unbend itſelf: ſuch is the ſpring of a clock, watch, and the like.

The ſpring of a lock, gun, piſtol, or the like, is a piece of ſteel, violently bent; which, being ſet at liberty, beats back the bolt of the lock, or ſtrikes down the cock.

SPRING-TIDE. See the article TIDE.

SPRINGY BODIES, the ſame with elaſtic ones; or ſuch as, having had their figure changed by the ſtroke of another body, can recover again their former figure, which bodies not elaſtic cannot do.

SPUNGE, in natural hiſtory, a plant of ſo very ſingular a ſtructure, that many authors have ſuppoſed it not merely a vegetable, but of an intermediate nature between that and the animal kind, and have ranked it among the number of an imaginary race of beings, which they call zoophytes. Spunge, however, is a genuine plant; nor is there in the creation any ſuch claſs of beings as zoophytes, or any creature that is partly plant, partly animal.

We meet with ſpunges, in the ſhops, often in the whole plant; ſometimes only in pieces of larger ones; in either caſe, it is of a perfectly irregular figure, and is only to be diſtinguiſhed by its texture, which is cavernous, like that of a honey-comb; its elaſticity, which makes it, after paſſing into a very ſmall compaſs, immediately expand to its full bulk again, on taking away the preſſure; and by its property of imbibing, perfectly, a large quantity of water, and as readily parting with it again, on ſqueezing.

Spunge is to be choſen perfectly clean, and free from ſtones within, or from a cruſtaceous and hard matter without; of as pale a colour as may be, and with ſmall holes, and ſuch as is lighteſt.

The greateſt part of the ſpunge we uſe, is brought from Aleppo and Smyrna. It grows in the Archipelago, at conſiderable depths, on the rocks about ſome of the iſlands there, and multitudes of people make a trade of diving for it. It is alſo common in the Mediterranean and many other ſeas, though in general, browner or yellower, and not ſo fine as that of the Archipelago.

It grows in large maſſes to rocks and ſtones, ſometimes to large ſhells; and is ſometimes round, ſometimes flat, ſometimes hollow, like a funnel. It is one of the cryptogamiæ of Linnæus, one of the herbæ marinæ of Tournefort, and one of the herbæ imperfectæ of Mr. Ray. It is deſcribed by all the botanical writers, under the name of ſpongia marina alba, and ſpongia globoſa, the white or round ſpunge. Diſtilled by a retort, it yields a large quantity of white milky phlegm, of a fiſhy ſmell; after this a large portion of an urinous

reddiſh liquor, with a little of a dry, volatile, urinous ſalt, and a thick, browniſh, fœtid oil. The remainder, in the retort, yields only a ſmall portion of a lixivial ſalt, and that not merely alcaline.

Spunge calcined to a blackneſs, and reduced to powder, has been lately brought into great uſe as a ſweetner of the blood, and a diuretic: ſome have pretended even to cure leproſies with it, and others have extolled it againſt the bite of a mad dog; but theſe are virtues leſs certainly known of it.

In the larger and coarſer pieces of ſpunge, there are often ſmall ſtones found imbedded in the ſubſtance of the matter; and yet, more frequently, a cruſtaceous ſparry matter gathered round the ſurface of certain parts of the plants; both theſe ſubſtances are called by the common name of lapis ſpongiæ, the ſponge-ſtone; and both are recommended as diuretics, and remedies againſt the ſtone and gravel. See SPAR.

Pyrotechnical SPUNGES are made of the large fungous excreſcences growing on old oaks, aſhes, fir, &c. which being boiled in common water, then dried and well beaten, are put in a ſtrong ley prepared with ſalt-petre, and again dried in an oven. Theſe make the black match or tinder brought from Germany, uſed to receive and ſuſtain the fire ſtruck from a flint and ſteel, &c.

SPUNGE is alſo uſed, in gunnery, for a long ſtaff or rammer with a piece of ſheep or lamb-ſkin wound about its end, to ſerve for ſcouring great guns, when diſcharged, before they are charged with freſh powder.

SPUNGE *of a Horſe-ſhoe*, the part next the heel, where the calkins are made.

SPUNGING, in gunnery, the cleaning a gun's inſide with a ſpunge, in order to prevent any ſparks of fire from remaining in her, which would endanger the life of him who ſhould load her again.

SPUR, a piece of metal, conſiſting of two branches encompaſſing a horſeman's heel, and a rowel in form of a ſtar, advancing out behind, to prick the horſe.

SPURIOUS DISEASES, ſuch as, in ſome ſymptoms, cannot be reduced to any one kind; and, therefore, are denominated from thoſe with which they agree in moſt particulars: thus we ſay, a ſpurious or baſtard pleuriſy, quinzy, &c.

SPY, a perſon hired to watch the actions, motions, &c. of another; particularly of what paſſes in a camp. When a ſpy is diſcovered, he is hanged immediately.

SQUADRON, in military affairs, denotes a body of horſe whoſe number of men is not fixed: but is uſually from one to two hundred.

Each ſquadron uſually conſiſts of three troops of fifty men each.

SQUADRON *of Ships*, a diviſion or part of a fleet, commanded by a vice-admiral, or commodore.

SQUALUS, the SHARK-KIND, in ichthyology, a numerous genus of fiſhes, of the chondropterygious order; the characters of which are theſe: the foramina of the gills are five on each ſide, and are ſituated in a longitudinal direction, from the ſides of the head down to the pectoral fins; the head is of a depreſſed form; the body is oblong, and is either rounded or angulated, and the ſkin is rough; the eyes ſtand on the ſides of the head; the tail is bifid; and the upper part longer than the under; the mouth is uſually tranſverſe, and in the under part of the roſtrum, not at its extremity.

The ſpecies of this genus being very numerous, are arranged under the following ſubdiviſions. 1. Thoſe which have granulated-teeth, as the ſaw-fiſh, and the ſmooth hound-fiſh. 2. Thoſe which have acute teeth, and prickles on the back; as the common hound-fiſh, the ſhagreen-fiſh, centrine and monk-fiſh. 3. Thoſe which have acute teeth, but no ſpines or prickles on the back; as the zygæna, or ballance-fiſh, the ſea-fox, and the tope. 4. Thoſe which have the roſtrum ſhorter than uſual; as the bounce, morgag, and blue and white ſharks.

SQUAMOUS, or SQUAMOSE, in anatomy, an appellation given to the ſpurious or falſe ſutures of the ſkull, becauſe compoſed of ſquamæ or ſcales like thoſe of fiſhes, or like tiles laid ſo as to reach over one another.

SQUARE, *Quadratum*, in geometry, a quadrilateral figure, both equilateral and equiangular.

To find the area of a ſquare, ſeek the length of one ſide; multiply this by itſelf, and the product is the area of the ſquare.

SQUARE NUMBER, the product of a number multiplied into itſelf.

Thus 4, the product of 2 multiplied by 2; or 16, the product of 4 multiplied by 4; are ſquare numbers.

SQUARE ROOT, a number conſidered as the root of a ſecond power or ſquare number; or a number by whoſe multiplication into itſelf, a ſquare number is generated.

SQUARE-BATTLE, or BATTALION *of Men*, is one that hath an equal number of men in rank and file.

Hollow SQUARE, in the military art, is a body of foot drawn up with an empty ſpace in the middle for the colours, drums, and baggage; faced and covered by the pikes every way, to keep off horſe.

SQUARE, *Norma*, an inſtrument conſiſting of two rulers, or branches, faſtened perpendicularly at one end of the extremes, ſo as to form a right angle: it is of great uſe in the deſcription and menſuration of right angles, and laying down perpendiculars.

SQUATT, among miners, a ſmall bed of ore leſs valuable than a vein or load, as reaching only a little way.

SQUINANCY, or ESQUINANCY, in medicine, the ſame with the quinzy. See QUINZY.

SQUINTING, *Strabiſmus*, in medicine and ſurgery. See the article STRABISMUS.

SQUIRREL, *Sciurus*, in zoology, the Engliſh name of a genus of quadrupeds of the order of the glires, the fore-teeth of which are prominent; it has no canine teeth; and its legs are formed both for climbing and leaping.

The common reddiſh-brown ſquirrel, with a white belly, is a very lively little animal, with an extremely long and buſhy tail.

But beſides this, there are ſeveral other ſpecies; as the American grey-ſquirrel, with a ſmaller tail, and twice as large as the common kind; the Ceylon blackiſh ſquirrel, with a very large tail, and about the ſize of the common ſquirrel; the flying-ſquirrel, with the ſides extended, ſo as to be able to leap from one tree to another at a great diſtance; and, laſtly, the Barbary ſquirrel, of a blackiſh tawny-brown colour, with variegated ſides.

STABLE, a place or houſe for horſes, &c. furniſhed with ſtalls and proper apartments to contain their food, &c.

Nothing conduces more to the health of a horſe than the having a good and wholeſome ſtable. The ſituation of a ſtable ſhould always be in a good air, and on a firm, dry, and hard ground, that in winter the horſe may go out and come in clean. It ſhould always be built ſomewhat on an aſcent, that the urine and other foulneſſes may be eaſily conveyed away by means of trenches or ſinks for that purpoſe. As there is no animal that delights more in cleanlineſs than the horſe, or that more abominates bad ſmells, care ſhould be taken that there be no hen-rooſt, hog-ſtie, or neceſſary-houſe, near the place where the ſtable is to be built; for the ſwallowing of feathers, which is very apt to happen, when hen-rooſts are near, often proves mortal to horſes; and the ſteams of a bog-houſe, or hog's-dung, will breed many diſtempers. The walls of a ſtable, which ought to be of brick rather than ſtone, ſhould be made of a moderate thickneſs, two bricks, or a brick and a half at leaſt, for the ſake of warmth in the winter, and to keep out the heat in the ſummer. The windows ſhould be made on the eaſt and north ſide of the building, that the north wind may be let in to cool the ſtables in the ſummer, and the riſing ſun all the year round, eſpecially in winter. The windows ſhould either be faſhed, or have large caſements, for the ſake of letting in air enough; and there ſhould always be cloſe wooden ſhutters, that the light may be ſhut out at pleaſure, by which means the horſe may be made to ſleep in the day as well as in the night, when it is judged proper he ſhould do ſo. Many pave the whole ſtable with ſtone, but that part which the horſe is to lie on ſhould be boarded with oak planks,

which ſhould be laid as even as poſſible, and croſs-wiſe rather than length-wiſe; and there ſhould be ſeveral holes bored through them to receive the urine, and carry it off underneath the floor into one common receptacle; the ground behind ſhould be raiſed to a level with the planks, and it ſhould be paved with ſmall pebbles. There are two rings to be placed on each ſide of the ſtall, for the horſe's halter to run through, and a logger is to be fixed to the end of this ſufficient to poiſe it perpendicularly, but not ſo heavy as to tire the horſe, or to hinder him from eating; the beſt place for him to eat his corn in is a drawer or locker, made in the wainſcot partition, which need not be large, ſo that it may be taken out at pleaſure to clean it, by which means the common dirtineſs of a fixed manger may be avoided. Many people are againſt having a rack in their ſtables; they give the horſe his hay ſprinkled upon his litter, and if they they think he treads it too much, they only nail up three or four boards, by way of a trough, to give it to him in: the reaſon of this is, that the continual lifting up of the head to feed out of the rack, is an unnatural poſture for a horſe, who was intended to take his food up from the ground, and makes him, as they expreſs it, withy-cragged. When there is ſtable-room enough, partitions are to be made for ſeveral horſes to ſtand in; theſe ſhould always allow room ſufficient for the horſe to turn about and lie down conveniently, and they ſhould be boarded up ſo high towards the head, that the horſes placed in ſeparate ſtalls may not be able to ſmell at one another, nor moleſt each other any way. One of theſe ſtalls ought to be covered in, and made convenient for the groom to lie in, in caſe of a match, or the ſickneſs of a horſe. Behind the horſes there ſhould be a row of pegs, to hang up ſaddles, bridles, and other utenſils; and ſome ſhelves for the bruſhes, pots of ointment, &c. The other requiſites for a ſtable are a dung-yard, a pump, and a conduit.

STACK *of Wood*, among huſbandmen, is a pile of three feet long, as many broad, and twelve feet high.

STADIUM, an antient Greek long meaſure, containing 125 geometrical paces, or 625 Roman feet, correſponding to our furlong.

The word is formed from the Greek στασις, ſtation; and it is ſaid, on this occaſion, that Hercules, after running ſo far at one breath, ſtood ſtill. The Greeks meaſured all their diſtances by ſtadia, which they call σταδιαζειν.

STADTHOLDER, STADTHOULDER, or STATHOLDER, a governor or lieutenant of a province in the United Netherlands; particularly that of Holland; where the word is moſt uſed by reaſon of the ſuperior importance of the government of that province.

Menage derives the word from *ſtadt*, ſtate, and *houder*, holding, q. d. lieutenant of the ſtates: others will have it compounded of *ſtad*, or *ſtede*, ſtead, or place, and *houder*, holding; in regard this officer held the place of the counts, and repreſented them in their abſence.

The ſtadtholder, that is, the ſtadtholder of Holland is the firſt member of the republic: he is chief of all the courts of juſtice, and may preſide therein when he pleaſes. All ſentences, judgments, &c. are diſpatched in his name. When an office becomes vacant in any of the courts, the ſtates propoſe three perſons to the ſtadtholder, who is to chooſe one of them.

He can even pardon criminals, which is a ſovereign prerogative, and has the choice of ſcabines, or chief magiſtrates in each city, to which end the council of the city preſent him two perſons, one of which he appoints.

STAFF, in muſic, five lines on which, with the intermediate ſpaces, the notes of any ſong or piece of muſic are marked.

STAFF, in ſurveying, a kind of ſtand whereon to mount a theodolite, circumferentor, plain table, or the like, for uſe. It conſiſts of three legs of wood joined together at one end, whereon the inſtrument is placed, and made ſharp at the other to enter the ground. Its upper end is uſually fitted with a ball and ſocket.

STAG, in zoology, a very ſtately and beautiful animal. People are apt to confound it with the common fallow deer, but with great impropriety, being of twice the ſize, and different in many other reſpects: the head is remarkably large; the neck ſtrong and thick; the eyes are full and large; the ears long and patulous; the horns tall, almoſt erect, and of a beautiful form; they riſe each with a ſingle and elegant ſtem, which continues its form to the top, only ſending off branches and divarications: they are hairy when firſt formed, but afterwards they become very ſtrong, and loſe that downy appearance. The body of the ſtag is round and plump, the back ſomewhat flatted, and the belly prominent: the legs are long, the hoofs cloven, the fur deep, thick, and of a tawny reddiſh colour.

STAGE, in the modern drama, the place of action and repreſentation, included between the pit and the ſcenes, and anſwering to the proſcenium, or pulpitum, of the ancients.

The laws of the ſtage are the rules and decorums to be obſerved, with regard to the œconomy and conduct of a dramatic performance to be exhibited on the ſtage. Theſe relate principally to the unities, the diſpoſition of the acts and ſcenes, the unravelling, &c.

STAGGERS, or STAVERS, in farriery. See the article STAVERS.

STAIR-CASE, in architecture, the aſcent incloſed between walls, or a balluſtrade, conſiſting of ſtairs, or ſteps, with landing places and rails, ſerving to make a communication between the ſeveral ſtories of a houſe.

The conſtruction of a complete ſtair-caſe is one of the moſt curious works in architecture. The common rules to be obſerved therein are as follows: 1. That it have a full free light to prevent accidents of ſlipping, falling, &c. 2. That the ſpace over-head be large and airy, which the Italians call *un bel ſfocato*, i. e. good ventilation, in regard a man ſpends much breath in mounting. 3. That the half paces, or landing-places, be conveniently diſtributed for repaſſing in the way. 4. That to prevent rencounters, &c. the ſtair-caſe be not too narrow: however, this laſt is to be regulated by the quality of the building. 5. That care be taken in placing the ſtaircaſe, ſo as the ſtairs may be diſtributed without prejudice to the reſt of the building.

The kinds of ſtair-caſes are various: in ſome the ſtairs are ſtraight, in others winding, in others both ways, or mixed. Again, of ſtraight ſtairs, called alſo fliers; ſome fly directly forwards, others are ſquare, others triangular, and others are called French flights. Of winding-ſtairs, called alſo ſpiral or cockle-ſtairs; ſome are ſquare, ſome circular, and ſome elliptical: and theſe again are various; ſome winding round a ſolid, and others round an open newel. Laſtly, of mixed ſtairs; ſome are called dog-legged, others both wind about a ſolid newel, and fly about a ſquare open newel.

Stair-caſes being of great importance in building, it will be neceſſary to give a particular account of each kind. Firſt, ſtraight-ſtairs are ſuch as always fly; that is, proceed in a right line, and never wind; whence their denomination. Of theſe there are ſeveral kinds, as, 1. Straight-fliers, or plain fliers, which proceed directly from one floor to another, without turning either to the right or left: theſe are ſeldom uſed, except either for garret or cellar ſtairs. 2. Square-fliers, which fly round the ſides of a ſquare newel, either ſolid or open, having at every corner of the newel a ſquare half ſtep, taking up one fourth of a circle, ſo that they fly from one half pace, or ſtep, to another; and the length of the ſtairs is perpendicular to the ſide of the newel. 3. Triangular fliers are thoſe which fly round by the ſides of a triangular newel, either ſolid or open, having at each corner of the newel a trapezial half-ſtep, taking up two thirds of a circle, ſo that they fly from one half ſtep to another, and their length is perpendicular to the ſide of the newel. 4. French fliers, thoſe which fly firſt directly forwards, till they come within the length of a ſtair of the wall, and then have a ſquare half-pace, from which you immediately aſcend to another half-pace, from which the ſtairs fly directly back again, parallel to their firſt flight.

Secondly, Winding-ſtairs are ſuch as always wind and never fly: of theſe there is great variety; as, 1. Circular winding ſtairs; of which there are four kinds, viz. ſuch as wind about a ſolid newel, the fore-edge of each

each being in a right line, pointing to the center of a newel; commonly uſed in church-ſteeples and great old houſes: ſuch as wind round an open newel, the fore-ſide of each being in a right line, pointing to the center of the newel, as thoſe in the Monument of London: ſuch as wind round a ſolid newel, only the fore-ſide of each an arch of a circle, either concave or convex, pointing near to the circumference of the newel, and ſuch as reſemble the laſt in all other reſpects, ſave that they have an open newel. Any of theſe winding-ſtairs take up leſs room than the other kinds. In ſtairs that wind round a ſolid newel, architects make the diameter of the newel either one ſixth, or one fourth, or one third, or three ſevenths, of the diameter of the ſtair-caſe, according as that is in bigneſs: if very ſmall, the newel is but one ſixth; and, if large, three ſevenths, &c. In ſtairs that wind round an open newel, Palladio orders the newel to be one half of the diameter of the ſtair-caſe, though there does not appear any reaſon why the newel here ſhould not be proportioned to the ſtair-caſe, as in the former. As to the number of ſtairs in each revolution, Palladio orders, that if the ſtair-caſe be ſix or ſeven feet diameter, the ſtairs in each revolution to be twelve; if the diameter be eight, the ſtairs to be ſixteen; or if nine or ten, the ſtairs to be twenty; and if eighteen, to be twenty-four. 2. Elliptical winding-ſtairs, whereof there are two kinds, the one winding round a ſolid, the other round an open newel: they are much of the ſame nature with circular ſtairs, excepting that in the one the newel is a circle, and in the other an ellipſis. 3. Square winding-ſtairs are ſuch as wind round a ſquare newel, either ſolid or open, the fore-ſide of each ſtair being a right line pointing to the center of the newel. 4. Triangular winding-ſtairs are ſuch as wind round a triangular newel, the fore-ſide of each being a right line pointing to the center of the newel. 5. Columniated winding-ſtairs. Palladio mentions a ſtair-caſe in Pompey's portico, at Rome, ſet on columns, ſo as the light they receive from above may diſtribute itſelf to all parts alike. 6. Double winding-ſtairs. Scamozzi mentions a ſtair-caſe in this form made by Piedro del Bergo and Jean Coſſin, at Sciamburg, in France, in the king's palace. It is ſo contrived, that the one aſcending and the other deſcending, ſhall never meet. Dr. Grew deſcribes a model of this kind of ſtair-caſe kept in the Muſæum of the Royal Society. The foot of one of the ſtair-caſes, he ſays, is oppoſite to that of the other, and both make a parallel aſcent, and within the ſame cylinder: the newel in the middle is hollow, and built with long apertures, to convey light from candles placed at bottom, and at the ſides of the newel, in both caſes. 7. Quadruple winding-ſtairs. Palladio mentions a ſtair-caſe of this form in the caſtle of Chambor, near Blois. It conſiſts of four ſtair-caſes, carried up together, having each its ſeveral entrance, and going up one over another in ſuch a manner as that being in the middle of the building, the four ſerve to lead to four apartments, ſo that the people of the one need not go up and down the ſtairs of the other; yet being open in the middle, they all ſee each other paſs.

Thirdly, mixed-ſtairs are ſuch as partly fly and partly wind; whence ſome call them fliers and winders. Of theſe there are ſeveral kinds: as, 1. Dog-legged-ſtairs, which firſt fly directly forwards, then wind a ſemicircle, and then fly directly backwards parallel to that. 2. Square-fliers and winders have a ſquare newel, either ſolid or open, and fly by the ſides of the newel, winding a quadrant of a circle at each corner. 3. Solid and open newelled fliers and winders are of two kinds: the one winds the quadrant of a circle about a ſolid newel, then flies by the ſide of a ſquare open newel, then winds again by the ſide of a ſolid newel, then flies again as before, and ſo alternately. The other flies firſt, then winds, then flies again, alternately.

The dimenſions of ſtairs are differently aſſigned by different authors; but, however, they agree in this, that they muſt not be more than ſix, nor leſs than four inches high; nor more than eighteen, nor leſs than twelve inches broad: nor more than ſixteen, nor leſs than ſix feet long, each ſtair. But theſe meaſures regard only large and ſumptuous buildings; for in common and ordinary houſes, they may be ſomething higher and narrower, and much ſhorter; yet even in theſe the ſtairs are not to exceed ſeven, or at moſt eight inches in height, nor be leſs than nine or ten inches in breadth, nor three feet in length. To reduce the dimenſions of ſtairs to ſome natural, or at leaſt geometrical, ſtandard, Vitruvius borrows the proportion of the ſides of a rectangled triangle, which the ancient ſchool expreſſed by the numbers 3, 4, and 5; the firſt for the perpendicular height, from the ſtair-head to the ground; the ſecond for the horizontal breadth; and the third for the whole ſlope, or inclination, from the edge of one ſtair to that of another. But this rule is laid aſide, and with good reaſon, by the modern builders; for on this principle, the lower the ſtairs, the narrower they muſt be; and ſtairs, for inſtance, four inches high, ſuch as we find mentioned by ancient architects, muſt be but five inches and one third broad.

One rule to be regarded in the making of ſtairs is, that they be laid ſomewhat ſloping, or a little higher behind, that the foot may, as it were, both aſcend and deſcend at the ſame time; which, though it is obſerved by few, is found a ſecret and delicate deception of the pains in mounting.

STAKE, the name of a ſmall anvil, uſed by ſmiths; ſometimes it ſtands on a broad iron-foot on the work-bench, to be moved up and down occaſionally; and ſometimes it hath a ſtrong iron-ſpike at the bottom, by which it is fixed to ſome place on the work-bench. Its uſe is to ſet ſmall and cold work ſtraight, by hammering it on the ſtake; or to cut or punch upon the cold chiſſel or cold punch.

STALACTITÆ, or STALACTAGNIA, STONY ICICLES, in natural hiſtory, cryſtalline ſpars formed into oblong, conical, round, or irregular bodies, compoſed of various cruſts, and uſually found hanging in form of icicles from the roofs of grottos, &c.

Of this claſs there are various ſpecies, as the hard, white ſtalactitæ; the white, ſhattery ſtalactitæ; and the yellow ſhattery cryſtalline ſtalactitæ, &c.

STALK, in botany, the ſtem or ſtock of a plant. Stalks are diſtinguiſhed into ſeveral kinds, viz. the naked ſtalk, which has no leaves on; creſted ſtalk, which has furrows, or ridges, winged ſtalk, which has leaves on both ſides; ſtriped ſtalk, which has two or more colours, &c.

STALLION, or STONE-HORSE, in the manege, an ungelt horſe, deſigned for the covering of mares, in order to propagate the ſpecies. See the articles HORSE and MARE.

STAMINA, in botany, thoſe fine threads or capillaments growing up within the flowers of tulips, lilies, and moſt other plants, around the ſtyle or piſtil. See PLANT.

The word is Latin, and literally ſignifies threads.

STAMINA, in the natural body, are defined to be thoſe ſimple original parts, which exiſted firſt in the embryo, or even in the ſeed, and by whoſe diſtinction, augmentation, and accretion, by additional juices, the animal body, at its utmoſt bulk, is ſuppoſed to be formed.

STAMINEOUS, in botany, a term uſed by authors, for thoſe flowers of plants which have no petals, or flower-leaves, but conſiſt only of a number of ſtamina and piſtils placed in a cup. This cup is ſometimes miſtaken for a flower, and its leaves thought to be true petals, but they remain when the ſtamina are fallen, and become the capſules containing the ſeed; which, according to Tournefort, is the true character of a cup, not of a flower.

STAMP-DUTIES, certain impoſitions laid on all parchment and paper, on which deeds, grants, or other inſtruments, or any proceſs in law or equity, are ingroſſed or written.

The ſtamp-duties are alſo extended to almanacs, newspapers, pamphlets, cards, and dice. All pamphlets above a ſheet, and under ſix ſheets in octavo, twelve in quarto, or twenty in folio, are ſubject to a ſtamp-duty.

STAMPS, in metallurgy, a ſort of large peſtles, liſted up by water wheels, and ſerving to beat to powder the ores, and the refuſe of ores, of metals. This engine is called

called the ſtamping-mill, and ſometimes the knocking-mill.

STAND, in commerce, a weight, from two hundred and a half to three hundred, of pitch.

STANDARD, in war, a ſort of banner or flags borne as a ſignal for the joining together the ſeveral troops belonging to the ſame body.

Du Cange derives the word from *ſtandarum*, or *ſtantarum*, *ſtandarum* or *ſtandale*, words uſed in corrupt Latin, to ſignify the principal flag of an army. Menage derives it from the German *ſtander*, or the Engliſh *ſtand*.

The ſtandard is uſually a piece of ſilk, a foot and a half ſquare, on which are embroidered the arms, device, or cypher, of the prince, or of the colonel: it is fixed on a lance eight or nine feet long, and is carried in the center of the firſt rank of a ſquadron of horſe.

The ſtandard is uſed for any martial enſign of horſe, but more particularly for that of the general, or the royal ſtandard: thoſe borne by the foot are rather called colours.

STANDARD, in commerce, the original of a weight, meaſure, or coin, committed to the keeping of a magiſtrate, or depoſited in ſome public place, to regulate, adjuſt, and try the weights uſed by particular perſons in traffic.

The juſtneſs of weights and meaſures is of that importance to the ſecurity and good order of trade, that there is no civilized nation, but makes it a part of their policy, to preſerve the equality thereof, by means of ſtandards. The ſtandards of weights and meaſures in England are appointed by magna charta to be kept in the exchequer by a ſpecial officer, called the clerk or comptroller of the market.

The ſtandard of gold-coin is twenty-two carats of fine gold and two carats of alloy in the pound weight troy: and the French, Spaniſh, and Flemiſh gold are nearly of the ſame fineneſs. The pound weight is cut into forty-four parts and a half, each current for twenty-one ſhillings. The ſtandard of ſilver is eleven ounces and two penny-weights of ſilver, and eighteen penny-weights of alloy of copper. Whether gold or ſilver be above or below ſtandard, is found by aſſaying, and the hydroſtatical ballance.

STANDARDS, or STANDELS, in huſbandry, are young trees, reſerved at the felling of woods, for the growth of timber.

STANNARIES, the mines and works where tin is dug and purified, as in Cornwall, Devonſhire, &c. There are four courts of the ſtannaries in Devonſhire, and as many in Cornwall, and great liberties were granted them by ſeveral acts of parliament, in the time of Edward I. &c. though ſomewhat abridged under Edward III. and Charles I.

STANZA, in poetry, a certain ſtated number of grave verſes containing ſome perfect ſenſe, terminated with a reſt or pauſe.

The word is Italian, and literally ſignifies a *ſtand*, or *ſtation*, becauſe of the pauſe to be made at the end of each ſtanza, or complete ſenſe.

What the couplet is in ſongs, and the ſtrophe in odes, the ſtanza is in the greater and graver pieces; as epic poems, &c.

STAPES, in anatomy, a little bone ſituated in a cavity of the feneſtra ovalis; thus called from its reſembling a ſtirrup.

STAPLE, *Stapula*, primarily ſignifies a public place or market, whither merchants, &c. are obliged to bring their goods to be bought by the people: as the Greve, or the places along the Seine, for the wines and corns of Paris; whither the merchants of other parts are obliged to bring thoſe commodities.

Voſſius and Menage derive the word from *ſtaplus*, which is found in the ripuary laws, ſignifying a place where juſtice is adminiſtered.

STAPLE alſo ſignifies a city or town where merchants jointly agree to carry certain commodities, as wool, cloth, lead, tin, &c. in order to their being commodiouſly ſold by the great. In England, ſtaples are ſettled and appointed to be conſtantly kept at York, Lincoln, Newcaſtle upon Tyne, Norwich, Weſtminſter, Canterbury, Chicheſter, Wincheſter, Exeter, and Briſtol, to which places merchants and traders were to carry goods to ſell in thoſe parts.

The ſtaple commodities of England are chiefly wool, leather, cloth, tin, lead, &c. though by ſtaple goods is now meant any proper ſaleable commodities not eaſily ſubject to periſh.

STAR, *Stella*, in aſtronomy, a general name for all the heavenly bodies, which, like ſo many brilliant ſtuds, are diſperſed throughout the whole heavens.

The ſtars are diſtinguiſhed, from the phænomena of their motion, &c. into fixed, and erratic or wandering ſtars: theſe laſt are again diſtinguiſhed into the greater luminaries, viz. the ſun and moon; the planets, or wandering ſtars, properly ſo called; and the comets.

As to the fixed ſtars, or ſimply ſtars, they are ſo called becauſe they ſeem to be fixed, or perfectly at reſt, and conſequently appear always at the ſame diſtance from each other.

Diſtribution and Number of the Fixed STARS. An obſerver will firſt divide theſe ſtars into ſeveral claſſes, according to the ſplendor of their light; the brighteſt he will call ſtars of the firſt magnitude; thoſe of the next inferior light, he will call ſtars of the ſecond magnitude; and ſo in order to thoſe which can barely be ſeen by the naked eye, which are called ſtars of the ſixth magnitude: and thoſe which cannot be ſeen but by the help of magnifying glaſſes, are of the ſeventh, eighth, &c. magnitudes. Afterwards, to avoid confuſion, and to be able to point out any one ſtar, without being obliged to give a particular name to each, he will divide them into ſeparate parcels, of which he will make a particular plan; and to each of theſe conſtellations, or parcels of ſtars, he will aſſign a figure at pleaſure, as that of a ram, a bull, a dragon, a Hercules, &c. but ſo that all the ſtars in each of the parcels, drawn in the plan, may be encloſed in the deſigned figures, and correſpond to the different parts from whence they take their name: for example, having drawn the figure of a bull about a parcel, or conſtellation, of ſtars, that ſtar which falls in the eye, will be called the ſtar in the bull's eye, or ſimply, the bull's eye; another, which reſpects the tip of one horn, will be named the bull's horn; and ſo of others. A parcel of ſtars thus contained in any aſſigned figure, is called a conſtellation.

By this means, notwithſtanding the ſeeming impoſſibility of numbering the fixed ſtars, their relative ſituations one to another have been ſo carefully obſerved by aſtronomers, that they have not only been able to number them, but even to diſtinguiſh the place of each ſtar in the heavens, and that with greater accuracy than any geographer could ever point out the ſituations of the ſeveral cities or towns upon the ſurface of the earth; and not only the places of thoſe few, if they may be ſo called, which are to be ſeen with the naked eye, have been pointed out and regiſtered by them, but even of thoſe which are diſcovered only by the teleſcope. The moſt ancient obſervations of the ſtars, which have reached theſe times, were made by Timocharis and Ariſtillus, about 300 years before Chriſt. The next after them, who made a catalogue of the ſtars viſible to the naked eye, and regiſtered their places, was Hipparchus of Rhodes; he flouriſhed about 120 years before Chriſt, and numbered 1022 ſtars. After him, Ptolemy enlarged his catalogue to 1026: Ulug Beigh, the grand-father of Tamerlane the Great, about the year 1437, conſtructed a new catalogue, more exact than that of Ptolemy, containing 1017 ſtars: Tycho, in the year 1600, determined the places of 777 fixed ſtars, and reduced them to a catalogue: Kepler's catalogue contained 1163 ſtars; and that of the prince of Heſſe, 400: Ricciolus enlarged Kepler's catalogue to 1468; and John Bayer, a German, had deſcribed the places of 1725 ſtars: after this, about 1670, Hevelius of Dantzick, compoſed a catalogue of 1888 fixed ſtars; Dr. Halley alſo undertook a voyage to the iſland of St. Helena, in order to take the poſition of the ſtars within the antarctic circle, of which he publiſhed a catalogue, containing 373 ſtars; but the largeſt and moſt complete catalogue ever yet publiſhed, is that of our accurate aſtronomer Mr. Flamſteed, in his Celeſtial Hiſtory, which contains near 3000 ſtars; all whoſe places are more exactly determined in the heavens, than the poſition of cities and other places on the earth.

We ought not, however, to imagine, that all the fixed ſtars are thus numbered, and reduced to their reſpective places in the heavens; ſince their number continually increaſes, according to the goodneſs of the teleſcope, appearing millions beyond millions, till, by their immenſe diſtance, they evade the ſight, even though aſſiſted by the beſt inſtruments. The teleſcopical ſtars with which Mr. Flamſteed has enriched his catalogue, are only the more remarkable ones, whoſe longitudes and latitudes, or ſituations in the heavens, it was thought worth while to regiſter and put down. Dr. Hook, with a teleſcope of twelve feet, ſaw 78 ſtars among the Pleiades; and with a longer teleſcope ſtill more; and, in the ſingle conſtellation of Orion, which, in Mr. Flamſteed's catalogue, has but 80 ſtars, there have been ſeen 2000. We may, therefore, venture to pronounce the number of fixed ſtars, including the teleſcopic ones as well as thoſe viſible to the naked eye, to be infinitely great, far beyond what it is poſſible for the beſt aſtronomers to calculate, much leſs to reduce to order. But though the ſtars are certainly innumerable, yet thoſe viſible to the naked eye, in one hemiſphere, ſeldom exceed a thouſand; which, perhaps, may appear ſtrange, ſince, at firſt ſight, their number ſeems immenſely great; but this is only a deception of ſight, ariſing from a confuſed and tranſient view; for let a perſon ſingle out a ſmall portion of the heavens, and after ſome attention to the ſituation of the more remarkable ſtars therein, begin to count, he will ſoon be ſurpriſed to find how few there are therein. However, even the number of ſtars viſible to the naked eye, ſmall as it is in compariſon with that of the teleſcopic ones, is far from being conſtant; ſince, beſides that the different ſtates of the atmoſphere renders many of the leſſer ſtars inviſible, ſome ſtars have been obſerved to appear and diſappear by turns; particularly one in the chair Caſſiopeia, in the year 1572, which, for ſome time, outſhone the biggeſt of the fixed ſtars, and in ſixteen months time, by degrees, vaniſhed quite away, and was never ſeen ſince: in the year 1640, the ſcholars of Kepler ſaw a ſtar in the right leg of Serpentarius, which likewiſe gradually diſappeared: Fabricius, in the year 1596, gives the firſt account of the *ſtella mira*, or wonderful ſtar, in the neck of the Whale; which has been ſince found to appear and diſappear periodically, its period being ſeven revolutions in ſix years, but is never quite extinguiſhed. Several other new ſtars have been obſerved: as one by Hevelius, in 1670; and another by Mr. Kirch, in 1689. Theſe new ſtars are generally obſerved in the galaxy, or milky way.

As to the cauſes of this appearing and diſappearing of the fixed ſtars, Sir Iſaac Newton conjectures, that as it is poſſible our ſun may ſometimes receive an addition of fuel by the falling of a comet into it: ſo the ſudden appearance of ſome ſtars, which formerly were not viſible to us, may be owing to the falling of a comet upon them, and occaſioning an uncommon blaze and ſplendor for ſome time: but that ſuch as appear and diſappear periodically, and increaſe by very ſlow degrees, ſeldom exceeding the ſtars of the third magnitude, may be ſuch as having large portions of their ſurfaces obſcured by ſpots, may, by revolving round their axes, like the ſun, expoſe their lighter and darker parts to us ſucceſſively.

Nature and Diſtance of the Fixed STARS. From the ſimilitude there appears to be between them and the ſun, it is generally ſuppoſed by philoſophers, that they are not placed in the heavens by way of ornament only, or to ſupply us with a faint light in the abſence of the moon; but that each of them is placed in the midſt of a ſyſtem of planetary worlds, and that it directs their motions, and ſupplies them with light and heat, in the ſame manner that the ſun does the ſeveral bodies of which our ſolar ſyſtem is compoſed; in ſhort, that they are ſo many ſuns, which no doubt have planets moving regularly round them, though inviſible to us. That this is not mere hypotheſis, will appear from the following arguments, drawn from the analogy they bear to our ſun: the ſun ſhines by its own native light, and ſo do the fixed ſtars: the ſun, at the diſtance of the fixed ſtars, would appear no larger than a ſtar; none of our planets, at that diſtance, could be ſeen at all: is it not probable, therefore, that each of the fixed ſtars is a fixed ſun, ſurrounded by a ſyſtem of planets and comets, which may be again furniſhed with different numbers of ſatellites, or moons, though inviſible to us? Beſides, as the number of ſtars is immenſely great, diſperſed through ſpaces of the univerſe, far beyond the reach of the beſt teleſcopes, and as God has made nothing in vain, it ſeems highly probable that they ſeverally ſerve the purpoſes of light and heat for the planets of their ſyſtems; ſince nothing can be more abſurd than to pretend that myriads of unſeen ſtars were made to twinkle in the unknown regions of the univerſe.

That the fixed ſtars ſhine by their own light is thus proved: when viewed through a teleſcope, they appear only as mere lucid points, deſtitute of all ſenſible magnitude, and conſequently muſt be at a vaſt diſtance; becauſe the ſatellites of Jupiter and Saturn, when viewed through a teleſcope, appear of very diſtinguiſhable magnitudes, and yet are inviſible to the naked eye. Since, then, the fixed ſtars are at ſuch a vaſt diſtance, that the beſt teleſcope has no power to magnify them, and nevertheleſs ſhine with a very bright and ſparkling light, it is inferred that they muſt ſhine with their own proper and unborrowed light; becauſe, if their light was only borrowed, they would, like the ſatellites already mentioned, be inviſible to the naked eye.

The celebrated Huygens found the brighteſt and largeſt, and conſequently the neareſt of the fixed ſtars, viz. Sirius, or the dog-ſtar, to be in appearance 27664 times leſs than the ſun; and ſince the diſtances of objects are greater as their apparent magnitudes are leſſer, the dog-ſtar muſt be diſtant from our earth 200000000000, or above two millions of millions of Engliſh miles: which is ſo very great, that a cannon-ball continuing in the ſame velocity it acquires when immediately diſcharged at the mouth of the cannon, would ſpend almoſt ſeven hundred thouſand years in paſſing through it: and it is very probable, that the fixed ſtars are equally diſtant from each other, as the neareſt of them is from our ſun; ſince, the better the teleſcopes we make uſe of, the more ſtars are ſeen. Hence it is very natural to conclude, that all the fixed ſtars are not placed at equal diſtances from us: but that they are every where interſperſed, at great diſtances beyond one another, throughout the univerſe; and that, probably, the different appearances which they make, in point of ſplendor and magnitude, may be rather owing to their various diſtances from us, than to any real difference in their magnitudes.

From what has been ſaid, concerning the number, nature, and diſtance of the fixed ſtars, the hypotheſis of a plurality of worlds, wherein each fixed ſtar ſerves as a ſun to a ſyſtem of planets, ſeems rational, worthy a philoſopher, and greatly diſplays the wiſdom, and redounds to the glory, of the great Creator and Governor of the uuiverſe.

Apparent Motions of the Fixed STARS. See ABERRATION.

Falling STARS, *Stellæ cadentes*, in meteorology, fiery meteors, which dart through the ſky in form of a ſtar; being occaſioned by a nitro-ſulphureous matter, the common cauſe of all ſuch meteors.

STAR, in heraldry, a charge frequently borne on the ſhield, and the honourable ordinaries, in figure of a ſtar; which differs only from the mullet, in not being pierced as this laſt is.

STAR is alſo a badge of honour, worn by the knights of the garter, bath, and thiſtle.

STAR, in pyrotechny, a compoſition of combuſtible matters, which, being thrown aloft in the air, exhibits the appearance of a real ſtar.

Stars are chiefly uſed as appendages to rockets, a number of them being uſually incloſed in a conical cap or cover, at the head of the rocket, and carried up with it to its utmoſt altitude, where the ſtars, taking fire, are ſpread around, and exhibit an agreeable ſpectacle.

To make ſtars, mix three pounds of ſalt-petre, eleven ounces of ſulphur, one of antimony, and three of gunpowder duſt: or twelve ounces of ſulphur, ſix of ſalt-petre, five and a half of gunpowder-duſt, four ounces of olibanum, one of maſtic, camphire, ſublimate of mercury,

cury, and half a one of antimony and orpiment. Moiſten the maſs with gum water, and make it into little balls of the ſize of a cheſnut, which dry either in the ſun or the oven. Theſe, ſet on fire in the air, will repreſent ſtars.

STAR-CHAMBER, a chamber at Weſtminſter, ſo called from having its roof painted with gilt ſtars.

STAR-FISH, *Aſterias*, or *Stella marina*, in zoology, a genus of naked inſects, in the form of a radiated ſtar: the mouth is ſituated in the centre, on the under part; and the anus in the center, on the upper part; the tentacula are extremely numerous, and in a manner cover, either the whole upper ſurface of the body, or the extremities of the ramifications.

The ſpecies of this genus, being very numerous, are diſtinguiſhed according to the number of their rays; they are alſo of different ſizes; the largeſt, or great Magellanic ſtar-fiſh, forming a circle of three feet in diameter, when its rays are fully extended, others not exceeding an inch in diameter.

STAR-SHOT, a gelatinous ſubſtance frequently found in fields, and ſuppoſed by the vulgar to have been produced from the meteor called a falling-ſtar: but, in reality, is the half digeſted food of herons, ſea-mews, and the like birds; for theſe birds, when ſhot, have been found, when dying, to diſgorge a ſubſtance of the ſame kind.

STAR-STONE, *Aſteria*, in natural hiſtory, a name given to certain extraneous foſſile ſtones, in form of ſhort, and commonly ſomewhat crooked, columns, compoſed of ſeveral joints; each reſembling the figure of a radiated ſtar, with a greater or ſmaller number of rays in the different ſpecies: they are uſually found of about an inch in length, and of the thickneſs of a gooſe-quill. Some of them have five angles, or rays, and others only four; and in ſome the angles are equi-diſtant, while in others they are irregularly ſo; in ſome alſo they are ſhort and blunt, while in others they are long, narrow, and pointed; and ſome have their angles ſo very ſhort and obtuſe, that at firſt ſight they might be taken for entrochoaſteriæ. The ſeveral joints in the ſame ſpecimen are uſually all of the ſame thickneſs; this however is not always the caſe, but in ſome they are larger at one end, and in others at the middle, than in any other part of the body; and ſome ſpecies have one of the rays bifid, ſo as to emulate the appearance of a ſix-rayed kind.

STARCH, a fecula or ſediment, found at the bottom of veſſels wherein wheat has been ſteeped in water; of which fecula, after the bran is ſeparated from it, by paſſing through ſieves, they form a kind of loaves, which being dried in the ſun, or an oven, is afterwards broke in little pieces, and ſo ſold.

The beſt is white, ſoft, and friable, eaſily broke into powder. Such as require very fine ſtarch, do not content themſelves, like the ſtarchmen, with refuſe wheat, but uſe the fineſt grain. The proceſs of making ſtarch of wheat is as follows: The grain, being well cleaned, is put to ferment in veſſels full of water, which they expoſe to the ſun when in its greateſt heat, changing the water twice a day, for the ſpace of eight or twelve days, according to the ſeaſon. When the grain burſts eaſily under the finger, they judge it ſufficiently fermented. The fermentation perfected, and the grain thus ſoftened, it is put handful by handful into a canvas bag, to ſeparate the flour from the huſks, which is done by rubbing and beating it on a plank, laid acroſs the mouth of the empty veſſel that is to receive the flour.

As the veſſels are filled with this liquid flour, there is ſeen ſwimming at the top a reddiſh water, which is to be carefully ſcummed off from time to time, and clean water put in its place; which, after ſtirring the whole together, is all to be ſtrained through a cloth or ſieve, and what is left behind put into the veſſel with new water, and expoſed to the ſun for ſome time; and, as the ſediment thickens at the bottom, they drain off the water four or five times, by inclining the veſſel, but without paſſing it through the ſieve; what remains at bottom, is the ſtarch, which they cut in pieces to get out, and leave it to dry in the ſun; when dry, it is laid up for uſe.

STATE, the policy or form of government of a nation.—Hence miniſters of ſtate, reaſons of ſtate, &c.

STATES, or ESTATES, a term applied to ſeveral orders or claſſes of people aſſembled to conſult of matters for the public good.

Thus ſtates-general, is the name of an aſſembly conſiſting of the deputies of the Seven United Provinces.

States of Holland are an aſſembly conſiſting of the deputies of the council, or colleges of each city, wherein reſides the ſovereignty of that province.

STATICS, that branch of mathematics which conſiders the motion of bodies ariſing from gravity. See MOTION.

Statics then is the doctrine, or theory, of motion, conſidered merely as ariſing from the weight of bodies; in which ſenſe it is diſtinguiſhed from mechanics, which is the application of ſtatics to machines, engines, &c. though it muſt be owned, that ſtatics and mechanics are frequently confounded.

STATICS, in medicine, a kind of epileptics, or perſons ſeized with an epileptic fit; during which they contemplate ſome ſtrong and lively idea, whereby they are diſtinguiſhed from cataleptics, or perſons ſeized with a catalepſy.

STATION, in geometry, ſurveying, &c. a place pitched upon to make an obſervation, take an angle, or the like.

STATIONARY, in aſtronomy, ſignifies the appearance of a planet, when it ſeems to remain immoveable on the ſame point of the zodiac for ſeveral days.

As the earth, whence we view the motions of the planets, is out of the center of their orbits, the planets appear to proceed irregularly; being ſometimes ſeen to go forwards, that is, from weſt to eaſt, which is called the direction; ſometimes to go backwards, or from eaſt to weſt, which is called the retrogradation. Now between theſe two ſtates there muſt be an intermediate one, wherein the planet neither appears to go backwards nor forwards, but to ſtand ſtill, and keep the ſame place in her orbit; which is called her ſtation; and this will happen, when the line that joins the earth's and planet's center is conſtantly directed to the ſame point in the heavens; that is, when it keeps parallel to itſelf. For all right lines, drawn from any part of the earth's orbit, parallel to one another, do all point to the ſame ſtar; the diſtance of theſe lines being inſenſible, in compariſon of that of the fixed ſtars.

Saturn is ſeen ſtationary at the diſtance of ſomewhat more than a quadrant from the ſun; Jupiter at the diſtance of fifty-two degrees; and Mars at a much greater diſtance.

Saturn is ſtationary eight days, Jupiter four, Mars two, Venus one and a half, and Mercury an half, though the ſeveral ſtations are not always equal.

STATIONARY-DAYS, in church-hiſtory, an appellation given to the weekly faſt-days, viz. Wedneſdays and Fridays; otherwiſe called half-faſts, and faſts of the fourth and ſixth days of the week.

Theſe faſts are certainly as ancient as Clemens Alexandrinus and Tertullian, who both mention them; and the reaſon of their inſtitution is, becauſe on the fourth day of the week the Jews took council to put our Saviour to death, which was actually accompliſhed on the ſixth: however, being in continual uſe throughout the year, they were not kept with ſuch rigour and ſtrictneſs as Lent.

STATIONARY-FEVER, a peculiar kind of fever, adapted, and owing, to ſome general conſtitution of the air and ſeaſons. Sydenham obſerves, that there are certain general conſtitutions of years which owe their origin neither to heat, cold, dryneſs, nor moiſture, but rather depend upon a certain ſecret and inexplicable alteration in the bowels of the earth, whence the air becomes impregnated with ſuch kinds of effluvia as ſubject the human body to peculiar diſtempers, ſo long as that kind of conſtitution prevails, which after a certain courſe of years declines, and gives way to another. Each of theſe general conſtitutions is attended with its own proper and peculiar kind of fever, which never appears in any other; and this is thence called a ſtationary-fever.

STATIVA, among the Romans, a ſtanding-camp kept for the defence of the frontiers of the empire. Theſe camps gave riſe to a great many towns, which took their names from the legion ſtationed there.

STATUARY, *Statuaria*, a branch of ſculpture, employed in the making of ſtatues.

Statuary is one of thoſe arts wherein the ancients ſurpaſſed the moderns; and indeed it was much more popular, and more cultivated among the former than the latter. It is diſputed between ſtatuary and painting, which of the two is the moſt difficult and the moſt artful. Statuary is alſo uſed for the artificer who makes ſtatues. Phidias was the greateſt ſtatuary among the ancients, and Michael Angelo among the moderns.

STATUE, *Statua*, is defined to be a piece of ſculpture in full relievo, repreſenting a human figure. Daviler more ſcientifically defines ſtatue a repreſentation, in high relievo and inſulate, of ſome perſon diſtinguiſhed by his birth, merit, or great actions, placed as an ornament in a fine building, or expoſed in a public place, to preſerve the memory of his worth. In ſtrictneſs, the term ſtatue is only applied to figures on foot, the word being formed from *ſtatura*, the ſize of the body.

Statues are formed with the chiſſel of ſeveral matters, as ſtone, marble, plaſter, &c. They are alſo caſt of various kinds of metal, particularly gold, ſilver, braſs, and lead. For the method of caſting ſtatues, ſee the article CASTING.

Statues are uſually diſtinguiſhed into four general kinds: the firſt are thoſe leſs than the life, of which kind we have ſeveral ſtatues of great men, of kings, and of gods themſelves; the ſecond are thoſe equal to the life, in which manner it was that the ancients, at the public expence, uſed to make ſtatues of perſons eminent for virtue, learning, or the ſervices they had done: the third, thoſe that exceed the life, among which, thoſe which ſurpaſſed the life once and a half, were for kings and emperors, and thoſe double the life, for heroes: the fourth kind were thoſe that exceeded the life twice, thrice, and even more, and were called coloſſuſes.

Every ſtatue reſembling the perſon it is intended to repreſent, is called *ſtatua iconica*. Statues acquire various other denominations. 1. Thus allegorical ſtatue, is that which, under a human figure, or other ſymbol, repreſents ſomething of another kind, as a part of the earth, a ſeaſon, age, element, temperament, hour, &c. 2. Curule ſtatues, are thoſe which are repreſented in chariots drawn by bigæ, or quadrigæ, that is, by two, or four horſes; of which kind there were ſeveral in the circuſes, hippodromes, &c. or in cars, as we ſee ſome, with triumphal arches, on antique medals. 3. Equeſtrian ſtatue, that which repreſents ſome illuſtrious perſon on horſe-back, as that famous one of Marcus Aurelius, at Rome: that of king Charles the firſt, at Charing-Croſs; King George the ſecond, in Leiceſter-Square, &c. 4. Greek ſtatue denotes a figure that is naked and antique; it being in this manner the Greeks repreſented their deities, athletæ of the Olympic games, and heroes: the ſtatues of heroes were particularly called Achillean ſtatues, by reaſon of the great number of figures of that prince in moſt of the cities of Greece. 5. Hydraulic ſtatue, is any figure placed as an ornament of a fountain or grotto, or that does the office of a jet d'eau, a cock, ſpout, or the like, by any of its parts, or by any attribute it holds; the like is to be underſtood of any animal ſerving for the ſame uſe. 6. Pedeſtrian ſtatue, a ſtatue ſtanding on foot; as that of King Charles the ſecond, in the Royal-Exchange; and of King James the ſecond, in the Privy-Gardens. 7. Roman ſtatue, is an appellation given to ſuch as are cloathed, and which receive various names from their various dreſſes.

Thoſe of emperors, with long gowns over their armour, were called *ſtatuæ paludatæ*; thoſe of captains and cavaliers, with coats of arms, *thoracatæ*; thoſe of ſoldiers, with cuiraſſes, *loricatæ*; thoſe of ſenators and augurs, *trabeatæ*; thoſe of magiſtrates, with long robes, *togatæ*; thoſe of the people, with a plain tunica, *tunicatæ*; and, laſtly, thoſe of women, with long trains, *ſtolatæ*.

The Romans had another diviſion of ſtatues into divine, which were thoſe conſecrated to the gods, as Jupiter, Mars, Apollo, &c. Heroes, which were thoſe of the demi-gods, as Hercules, &c. and Auguſti, which were thoſe of the emperors, as thoſe two of Cæſar and Auguſtus, under the portico of the Capitol. In repairing a ſtatue caſt in a mould, they touch it up with a chiſſel, graver, or other inſtrument, to finiſh the places which have not come well off: they alſo clear off the barb, and what is redundant in the joints and projectures.

STATURE, the ſize or height of a man.—From the Latin *ſtatura*, or *ſtare*, to ſtand.

The ſtature, or pitch of a man, is found admirably well adapted to the circumſtances of his exiſtence. Had man, obſerves Dr. Grew, been a dwarf, he could ſcarce have been a reaſonable creature: for, to that end, he muſt have had a jolt head; and then he would not have had body and blood to ſupply his brain with ſpirits: or, if a ſmall proportional head, there would not have been brain enough for his buſineſs.—Again, had man been a giant, he could not have been ſo commodiouſly ſupplied with food; for there would not have been fleſh enough of the beſt eatable beaſts to ſupply his turn; or, if the beaſts had been made proportionably bigger, there would not have been graſs enough, &c.

It is a common opinion, however, and has been ſo ever ſince Homer's time, that people, in the earlieſt ages of the world, much ſurpaſſed the moderns in ſtature; and it is true, we read of men, both in ſacred and profane hiſtory, whoſe pitch appears ſurpriſing: but then it is true, that they were eſteemed giants.

The ordinary ſtature of men, Mr. Derham obſerves, is, in all probability, the ſame now, as at the beginning; as may be gathered from the monuments, mummies, &c. ſtill remaining. The oldeſt monument in the world is that of Cheops in the firſt pyramid of Egypt, which, Mr. Greaves obſerves, ſcarce exceeds the meaſure of our ordinary coffins. The cavity, he ſays, is only 6.488 feet long, 2.218 feet wide, and 2.160 deep: from which dimenſions, and thoſe of ſeveral embalmed bodies, taken by him in Egypt, that accurate writer concludes, there is no decay in nature; but that the men of this age are of the ſame ſtature as thoſe three thouſand years ago.

To theſe we have other and later inſtances to add from Hakewell: the tombs at Piſa, which are ſome thouſands of years old, are no longer than ours. The ſame may be ſaid of Athelſtan's in Malmsbury church; Sheba's in Paul's, of the year 693, &c.

The like evidence we have from the ancient armour, ſhields, veſſels, &c. dug up at this day; for inſtance, the braſs helmet dug up at Metaurum, fits one of our men; yet it is allowed to have been left there at the overthrow of Aſdrubal. Add, that Auguſtus was five feet nine inches, which was the meaſure of our queen Elizabeth; only the queen exceeded the emperor by two inches, allowance being made for the difference between the Roman and our foot.

STAVERS, or STAGGERS, among the farriers, a giddineſs in a horſe's head, which ends in madneſs. The ſigns of it are dimneſs of ſight, reeling and ſtaggering, watery eyes, &c. at length, for very pain he beats his head againſt the wall, thruſts it into the litter, riſes and lies down with fury, &c. The methods of cure are various; but they all begin with bleeding. However, the moſt approved remedy for this diſtemper, which ſhews itſelf in horſes in a giddineſs, and reeling about, in waterineſs of the eyes, and a variety of odd motions of the head, is the following method: The creature is firſt to be blooded largely, then a glyſter is to be given him, compoſed of two quarts of emetic wine, and four ounces of the unguentum populneum. When he has repoſed an hour or two after voiding his glyſter, let another be given him, made of two ounces of the ſcoriæ of the liver of antimony finely powdered, boiled a little while in five pints of beer, and with the addition of four ounces of the ſame ointment, or of ointment of roſes. This laſt glyſter is to be frequently repeated, and his legs are to be all the while rubbed ſtrongly with wiſps of hay, wetted in warm water, to make a revulſion. His food ſhould be bran and white-bread, and he ſhould be walked from time to time in ſome temperate place. If theſe methods do not ſucceed, let an ounce of Venice treacle be diſſolved in a quart of ſome cordial waters, and given him; and, after this, let the following glyſter be given warm: Take Venice treacle and ſal polychreſtum, of each two ounces; diſſolve them in two quarts of a decoction of mallows and camomile flowers; add a quarter of a pint of oil of rue. This

repeated

repeated two or three times after bleeding, and the other methods, will often cure the worſt ſtages of this diſeaſe.

STEEL, a kind of iron refined and purified by the fire with other ingredients, which renders it whiter, and its grain cloſer and finer than common iron.

Steel, of all other metals, is that ſuſceptible of the greateſt degree of hardneſs, when well tempered; whence its great uſe in the making of tools and inſtruments of all kinds.

The manner of making iron into ſteel had remained very long a ſecret; but many authors of late date have given the proceſs, though it does not appear the ſame in all, and in many is encumbered with circumſtances intended only to diſguiſe it. Mr. Reaumur has taken greater pains, than almoſt any man, to come at the truth; but, to be rightly informed of his reaſons, we ought to begin where he did, that is, at the origin of the iron in its pure metallic ſtate.

The ores of this metal are mixed bodies, compoſed of ſome particles truly metallic, and of others ſulphureous, ſaline, and terrene; this compound maſs is put in fuſion by the fire, and on this operation the metallic parts, being heavieſt, ſubſide to the bottom of the veſſel, or furnace, and are then eaſily ſeparated from the lighter ſubſtances which float at the top. This ſeparation, however, is not ſuppoſed to be perfect; but the metal, after this its firſt fuſion, retains many heterogene particles, which prevent it from being malleable. It is after this to be refined, that is, to be melted again, and, that ever ſo often performed, the metal becomes yet more and more pure and perfect, ſome heterogene matter being every time depoſited, or thrown off; and this is uſually much leſs after every fuſion. The metal, when thus purified, by melting, yet remains hard and brittle: theſe are two qualities which we do not want in iron, and this hardneſs and friability are no incompatible qualities, ſince their origin is this, that the iron in this ſtate is compoſed of a multitude of ſmall granules, every one of which is very firm and compact in its own texture, though they cohere but ſlightly one with another. The knife, or the file, cannot eaſily cut any one of theſe granules, but a blow of a hammer eaſily ſeparates large parcels of them from thoſe to which they were joined: this caſt iron is therefore uſed only for ſuch purpoſes as requires a ſubſtance poſſeſſed of theſe qualities; purpoſes where hardneſs is required, and where no blows are to be met with. Thus, backs of grates, iron pots, and the like, are made of it.

One of the general properties of metals is, that they are malleable; that is, their ſeveral particles cohere ſo well together, that they are ductile and extenſible under the hammer, and will ſuffer the whole maſs to bend any way without breaking, that is, without their ſeparating from one another. In the works of the artizans, ſuch ſuppleneſs and pliability is called body in a metal, and the caſt iron, which wants this, is ſaid to have no body, and is what they call no ſoft metal. It is therefore no way fit for ſuch works as require faſhioning by the hammer or the file, nor of ſuch as are to ſtand any violent blows; but, as it is eaſily fuſible, it ſerves for the caſt works where there is no great delicacy in the figuring, ſince it does not run ſo thin as to adapt itſelf to every lineament of a fine figure, nor is qualified to be repaired by inſtruments.

The ill qualities of caſt iron are, in a great degree, remedied in the forged or wrought iron, taken from the ſame quantity, and the ſame fuſion. The forging of iron is only the placing it over the fire till heated to a certain degree, and then beating it out with large hammers till it becomes ſoft. When it has been ſufficiently forged, it becomes ſoft and malleable, even when cold, and, when heated, is eaſily wrought into any figures, which it retains afterwards; and it is eaſily cut by the file when cold, and is not brittle on being ſtruck, as is the caſt iron.

While it gains theſe properties by the forging, it loſes, however, another by the ſame means, which is its fuſibility. It will no longer melt in the fire, but when the workmen give it the ſtrongeſt heat they can, it is only reduced to a ſort of ſoft paſte, and ſweats a little, as they expreſs it; that is, ſome few drops of truly melted iron fall from it.

It is very certain, that both the caſt and the forged iron are mixtures of metalline, ſaline, and ſulphureous particles; and the different arrangement of theſe, in their mere ſimple running together in the fuſion, and their being driven intimately into, and among one another, by the hammering, makes the fuſibility different in the two ſtates.

If the forged iron differ greatly from the caſt, there is however a third ſtate into which it is reducible by art, which is yet different from both; this is what we call Steel; and the quality of iron on receiving this change is not one of its leaſt valuable ones, ſince from this we have all our inſtruments for cutting, ſawing, boring, and the like purpoſes, the value of which to us is almoſt infinite. The German ſteel has always been in great repute, and, though ſeveral other nations have made it, yet the Germans have kept their method a ſacred myſtery, to keep up their trade in it.

Steel is conſiderably harder than forged iron, and ſo it is neceſſary that it ſhould be, in order to many of the purpoſes it is employed in. Shears of ſteel, which are intended to cut iron, muſt be harder than iron, otherwiſe their edge will turn, and they will not cut; whereas, if the metal is too hard, then the granules will fly off, and the edge break away in ſmall fragments. This is the caſe with all edged tools; and hence it is, that good ſteel is ſo nice and difficult a thing to make, ſince there is required ſuch a degree of hardneſs, and no more.

It is very well known, that ſteel acquires its hardneſs from the plunging it into water; it is to be heated to a certain degree, and then immediately plunged, while the fiery particles yet remain in it, into water perfectly cold; it is then to be ſpeedily drawn out of the water, and thus the whole operation is finiſhed. It acquires its hardneſs in degrees, proportionate to its heat when plunged into the water; and this hardneſs, or temper, remains with it only till it is heated as high again; for, after that, if left to cool leiſurely, and not thrown into water, it is loſt. All the maſſes of ſteel which are ſold are thus tempered; nevertheleſs, when they are wrought into tools, their temper is loſt, and is to be renewed by plunging them again into cold water, when they have been forged into the ſhape of which they are to be.

Mr. Reaumur affirms, that ſteel differs in nothing from forged iron, except that it contains more ſulphurs, and more ſalts. Hence, it follows, that caſt iron ſhould be ſteel, ſince it evidently differs from forged iron in the ſame manner, and by the ſame properties; and, in effect, caſt iron is ſteel, ſuch as it is, eſpecially the white ſort, which is more pure, and more perfectly diveſted of its earth, than the browner ſorts; and this white kind may be accordingly brought to all the hardneſs of ſteel, by repeated heating and quenching in cold water. It follows alſo, that in order to convert iron into ſteel, we are to give it new ſalts and new ſulphurs. It may be aſked, where is the neceſſity of giving again that which the mere caſt iron poſſeſſes? To which the anſwer is, that ſteel is required to be malleable in ſome degree, which the mere caſt iron is not; and it is to be added to this, that it may be poſſible for us to give to forged iron ſuch ſalts and ſulphurs as are more proper for the ſteel, than thoſe which the caſt iron naturally poſſeſſes.

We have great variety of ſalts and ſulphurs, out of which to chuſe for this purpoſe, and Mr. Reaumur made many trials to find which would ſucceed beſt; and the reſult of all was, that, for ſulphurs, powdered charcoal and common ſoot; and, for ſalts, ſea ſalt alone ſucceeded beſt; and that theſe were properly to be mixed with aſhes, by way of an intermediate ſubſtance.

Theſe ſubſtances muſt alſo have their allotted doſe; that is, there muſt not only be a certain proportion of the ſeveral ingredients one to another, which, however, need not be very preciſe and exact, but there muſt alſo be a proportional quantity of the whole employed to the quantity of iron that is to be wrought upon; and in this alſo regard muſt be had to the ſeveral ſorts of ores from which the iron was obtained, ſince the iron of ſome ores

ores is much ſooner convertible into ſteel than that of others, and makes alſo a better ſteel.

The manner of beſt introducing theſe ſalts and ſulphurs into the body of the iron was found by this author a matter of great difficulty to determine. He ſoon perceived, that fire was the only agent that could convey theſe bodies into the metal; and in contriving how this might be done moſt eaſily, and with leaſt expence, he found out, after many trials, a new ſort of furnace, which effected this purpoſe with great eaſe, and which was not ſubject to the inconveniencies of other furnaces.

As ſteel is iron with an admixture of heterogene particles, it follows that it muſt be leſs metallic, that is, leſs malleable, or more brittle; it is alſo neceſſary that it muſt be, in ſome degree, malleable for the purpoſe it is required for; and it is eaſy to conceive that theſe properties cannot be given it, in a proper degree, but by means of a very accurate operation; and, even when all the parts of the proceſs are the ſame, there is yet much depending on the iron itſelf, which can never be perfectly known but by trial. Something, however, may be judged of the iron by breaking bars of it: the ſeveral ſorts of iron, when broken, ſhew ſome of them only granules, others flakes, and others fibres; ſome alſo ſhew all three of theſe moleculæ at once, and others two of them; but it is eaſy, in either of theſe caſes, to ſee which ſort is in the greateſt number.

The laminated and the fibrous iron are the two extremes; the firſt is very brittle, the latter very malleable. The laminated iron is ever the worſt of all kinds for making into ſteel; and of this kind ſuch pieces are worſt of all, the laminæ of which are very white and ſhining, and are large and irregularly diſpoſed, and arranged in different inclinations. Mr. Reaumur began to reckon from theſe an arrangement of all the kinds of iron, which coming, each by degrees, to have the laminæ ſtill ſmaller and ſmaller, and at the ſame time leſs glittering, and placed more evenly together, ſunk at laſt into the irons of the granulated kind. It is eaſy to conceive how many differences there muſt be between theſe; and from theſe the fibroſe ones may be deduced, owing their texture merely to the granulæ, which in theſe are diſpoſed into long ſtrings or ſtreaks. Though, in this arrangement of the irons, the firſt are, of all others, the leaſt proper for making ſteel, it does not follow that the laſt are the moſt ſo; theſe indeed uſually make a very ſoft and pliant ſort of ſteel, which has what the workmen call the greateſt body of all the kinds of ſteel, and is therefore moſt proper of all for certain purpoſes, as the making of watch ſprings, and the like; but the want of hardneſs makes it very unfit for cutting tools of all kinds, from the razor to the ax. The granulated iron always makes the fineſt and hardeſt ſteel: and of theſe ſuch ſucceed beſt, whoſe granules are ſmalleſt.

One thing remarkable is, that all ſteel, though made of iron of the granulated or ſtriated kind, yet is, before it has been hammered, of a flaky, or a ſort of laminated ſtructure; but this ſeems owing to the fire's having melted ſome of the granules in the operation, and run great numbers of them together into theſe plates. The ſmallneſs of theſe flakes in ſteel, which has not been worked, are a proof of its being a bad kind.

A bar of iron, when converted into ſteel, is not equally ſo converted in all its parts; the fire has always acted more ſtrongly on its ſurface than on its central parts, and it is therefore more perfectly ſteel there than in its inner parts; but a perfection in the operation is not neceſſary to the ſteel's being good and uſeful, and the whole bar is often very good ſteel, as are alſo many bars made at the ſame time, yet all, perhaps, ſomewhat differently affected.

If the compoſition, which is to convert the iron into ſteel, be too ſtrong, or if the fire be too violent, or the matter contained too long in it, in all theſe caſes the ſteel will be over made; that is, there will be an over proportion of ſaline and ſulphureous parts added to the iron: theſe will therefore too far ſeparate the particles of the metal aſunder, and the conſequence will be, that the ſteel will be too brittle to bear hammering, and will be of great loſs to the proprietor in the great quantities that will be broken, beſides the loſs he will have from the abundance of ſcales which will fly off in the working. The way to meliorate ſuch ſteel as this muſt be to diveſt it of a part of its ſalts and ſulphurs, but particularly of the laſt; and Mr. Reaumur found, that by the burying the bars of ſuch ſteel in lime, or any other alkaline ſubſtance that would readily abſorb the ſulphurs, and placing it for a proper time in the fire, it would be in a manner decompoſed again, and come out a very good and perfect ſteel; and this is no trivial proof, that the account given of the manner of iron's becoming ſteel is the true one.

By this management ſteel may again be converted, or reduced to its primitive iron, and a body of any middle degree, between ſteel and iron, may be produced, by ſtopping this proceſs at different points of time, or continuing it till all the adventitious ſalts and ſulphurs are drawn off or abſorbed. Hardneſs and flexibility are the two great points of this operation, and what the metal gets of the one of theſe, it aſſuredly loſes of the other. The greater hardneſs is from the greater quantity of the adventitious ſalts and ſulphurs; and the greater flexibility, or as the workmen call it, the greater body, is from the greater quantity of the metallic; and he who is able to calculate properly the quantities of his ſalt, charcoal, and ſoot, and to regulate exactly the degree of fire, is capable to make ſteel of what degree of temper or perfection he pleaſes.

Iron, impregnated with new ſalts and new ſulphurs, is not however perfectly reduced to the ſtate of what the workmen expect in ſteel; there wants yet the quenching it while hot in cold water, to compleat the operation. The ſteel, penetrated every way by the particles of fire, and at that inſtant plunged into water, is by that quenching ſtopped in the very ſtate in which it was, and is not ſuffered to exhale the igneous bodies, as it would otherwiſe have done. It was, while in the fire, rarified and dilated, and this quenching continues it in that ſtate, and it is found, on meaſuring, conſiderably thicker and larger than it was while unheated. It might be ſuppoſed from hence, that the particles of fire, which were lodged in the ſteel while red-hot, were thus detained and impriſoned in it, and ſo wrought the change, as they are known to remain in many calcined bodies, though they have not been ſo ſuddenly quenched; but, if this were the caſe, the ſteel muſt be increaſed in weight as well as bigneſs, as many calcined bodies are; but this is not found to be ſo in fact.

Recourſe muſt be had therefore to ſome other operation on the ſteel; and this appears, in reality, to be no other than the change of its texture, or internal ſtructure. If a body be naturally compoſed of a number of particles, which are in themſelves hard and compact, but between which there are certain ſpaces; if one takes from theſe hard and compact particles ſomewhat to fill up theſe voids, it muſt appear very evidently, that, though by this the proper particles are rendered leſs hard, yet the whole body muſt be made harder than it was before. In the converting of iron into ſteel, Mr. Reaumur conceives that the particles of iron, being naturally very covetous of ſalts and ſulphurs, have imbibed great quantities of theſe adventitious bodies, while the ſpaces between them have been able to retain very few. This being then the firſt ſtate of the ſteel, when it is afterwards heated, in order to its being tempered by quenching, the fire drives theſe ſulphureous and ſaline particles, ſo abundant in the iron, out of its granules, and diſperſes them throughout the ſpaces between theſe granules; and that it is to this equal and regular diſtribution of theſe ſalts and ſulphurs, fixed in this ſtate by the inmmediate quenching, that the hardneſs and other qualities of ſteel are owing.

To the advantage the metal gets by this means, there is however always joined a diſadvantage, which is, that its grain naturally and neceſſarily becomes coarſer by it, and the ſteel has the leſs body. The hardeſt ſteel always muſt neceſſarily have the leaſt body; but according to the rules laid down by Mr. Reaumur, one may diſpoſe the hardneſs in what degree one pleaſes, and conſequently all the other properties are in the direction of the ſame laws.

If the oppoſition of the qualities of ſteel be nicely conſidered, we ſhall find, that, inſtead of being hurtful, they are truly what ſhould be moſt wiſhed for, and are productive of the moſt deſireable conſequences. It may appear ſomewhat ſtrange, that hardneſs and flexibility in ſteel ſhould be ſuch directly oppoſite and contradictory principles, and that the quenching, which makes ſteel more powerful to reſiſt preſſure or rubbing, ſhould, at the ſame time, make it more feeble in action; but this is plainly the caſe, and a piece of ſteel wire, which, before it is tempered by quenching, will when hung vertically, ſuſpend a certain weight, will not ſuſtain the ſame weight when tempered, but will be broken even by a leſs; and that if the trial be made by tempering it up to one certain part, and no farther, the wire will aſſuredly break at that very part where the tempered and non-tempered portions meet. The increaſe of ſize in every grain of ſteel, from the quenching, gives the plain ſolution of this phænomenon. The rupture of any body whatever, that is, the ſeparation of its parts, by whatever means it is done, muſt be more difficult, the more intimately thoſe parts touch, or the more points they touch in. The granules of ſteel are thoſe touching parts, and it is very evident that theſe granules, becoming larger on the quenching, muſt after this touch in fewer points, in the whole combination of the maſs; and, on the other hand, as they are larger, they alſo muſt mutually touch each other in a larger ſpace. Here are two contrary principles, which conſtitute the facility and the difficulty of the rupture by different means; and it cannot be, but that the one of theſe conſtrictions muſt give the greater force to reſiſt preſſure or friction, and the other to reſiſt drawing or traction.

It has been already obſerved that ſteel is the harder, according as it was more or leſs hot at the time when it was plunged into the water; and it muſt be added to this, that it alſo is the more ſo, the more cold the water is into which it is plunged. The degree of heat in the ſteel is eaſily known by its colour, and the diſtinctions in it are familiar to the workmen. Several perſons have thought there was great virtue to be communicated to the water by means of different ingredients: this Mr. Reaumur carefully tried, and the reſult was, that he found common cold water the beſt and moſt uſeful of all liquors: it is true, that vinegar and verjuice harden the ſteel ſomewhat more, and aqua fortis greatly ſo; but the latter of theſe renders it too hard for ſervice, and repeated trials have evinced, that common water alone will give ſteel all the hardneſs it can be wiſhed to have, provided only that it be plunged into it at a time when it is ſufficiently hot. If ſteel, after tempering, be found too hard, there is a very familiar way of bringing it back to what ſtate one pleaſes, between that and iron, which is only the heating it in the fire; for it may be kept in the fire ſo long, as to be reduced wholly to iron again. It is eaſy to infer from hence, what was before obſerved, that caſt iron is ſteel of a peculiar kind; its properties plainly evince, that it is ſteel with an over proportion of all that makes it ſo, and conſequently of all its properties. It is not malleable, is very brittle, and too hard for the file, or any other tool, to cut. Theſe are the qualities of ſteel which is over tempered, or, as it may be called, too much ſteel: it owes theſe qualities to its being overcharged with thoſe ſulphurs and ſalts, which in a due proportion make ſteel of iron. The method of reducing this to the ſtate of wrought iron is the ſame that we have before obſerved is to be uſed to untemper too high tempered ſteel, that is, keeping it in the fire till part of its ſalts and ſulphurs are driven off; and, if the fire alone be thought too difficult or too tedious a method, Mr. Reaumur has found that thoſe alkaline ſubſtances, which naturally abſorb ſulphurs, will aſſiſt the reducing this to the ſtate of wrought iron, as they do to the untempering of ſteel; and that the very ſame ſubſtances of this kind, which have been found beſt in the untempering ſteel, ſucceed beſt in the rendering this malleable; ſuch are lime, chalk, and the like.

Caſt iron may be taken for theſe operations in two ſtates; the one that of ſimply melted iron in its firſt fuſion, the other that of the iron which has been run into the mould. When a caſt piece of iron, in a certain form, is heated again with the calx of animal bones, which is one common way, this being a ſubſtance extremely diveſted of ſalts and ſulphurs, it abſorbs thoſe of the metal too greedily, and diveſts it of too great a quantity of them; ſo that, when the piece comes afterwards to be filed, the fragments fly off in large ſcales, and the beauty of the caſt figure muſt be loſt: to remedy this difficulty, ſome powdered ſulphur is to be added in the heating; for this, being a ſulphureous and ſaline body, checks and moderates the effect of the calx of bone.

Chalk in the ſame manner can only be employed with certain regulations; it ſucceeds very well, if the fire be not too violent, or too long continued; but, if it be exceſſive in either of theſe particulars, the chalk throws into the body of the iron ſalts and ſulphurs of its own, which lay hid in its ſtructure, and which would not have been diſlodged by a ſmaller fire; but which being diſlodged, and thrown into the iron, act upon it, and render the ſucceſs of the operation quite different from what was intended, the iron becoming more hard and more brittle by it.

One great nicety, in all theſe operations, is the underſtanding the ſigns by which it is known at what time caſt iron is ſufficiently ſoftened, or overtempered ſteel is ſufficiently reduced towards the ſtate of iron again; but this is only to be acquired by nice obſervation, and on this depends the whole certainty of the proceſſes, ſince every minute's continuance in the fire gives the operation a different turn in degree.

Mr. Reaumur, in one of his experiments in the ſoftening a piece of caſt iron of a beautiful figure, found, on taking it out, that it had loſt prodigiouſly of its weight; and, coming to a nicer examination, he found that it was hollow, its outer cruſt having been ſooner converted into malleable, that is, into fuſible iron, than the reſt, and the violence of the fire afterwards having melted away the inner part, which was not yet ſo changed. This accident led him to experiments, by which he found that he could, at any time, melt out the central part of a thick ſquare bar of caſt iron, the outer part changing firſt into the condition of malleable iron, and ſerving as a crucible for the fuſion of the yet unaltered fuſible iron within. By a proper management of this diſcovery, it will be eaſy to take off the unwieldy weight of many works of caſt iron, which do not require ſo much ſtrength as that of the ſolid contained in their circumference. *Mem. de l'Acad. des Scien.* 1722.

Mr. Cramer obſerves, that the method of making ſteel out of iron, is either by fuſion, or by cementation. That by cementation may be performed in the following manner: chuſe ſome bars of pure iron, not too thick: prepare a cement of charcoal duſt, moderately pulveriſed, one part, and wood aſhes half a part; or of charcoal duſt two parts, bones, horns, leather, or hair of animals, burnt to a blackneſs in a cloſe veſſel, and in a gentle fire, and afterwards reduced to a powder, one part, wood aſhes half a part; mix them together. Prepare a cylindrical earthen veſſel, two or three inches higher than the bars are long; put into the bottom of this veſſel the cement, prepared as before directed, ſo that, being gently preſſed down, it may cover the bottom of the veſſel an inch and a half deep; place then the iron bars perpendicularly, ſo that they may be every-where an inch diſtant from the ſides of the veſſels, and from each other; fill the interſtices with the cement, and cover the bars with it, that the veſſel may be quite full; cover it with a tile, and ſtop the joints with a lute; put this veſſel into a furnace, and keep it moderately, but equally red-hot, for ſix or ten hours. When this is over, take the red-hot bars out, and dip them in cold water; they will then be brittle, and turned to ſteel.

The method of making ſteel by fuſion is this: take of iron ore, or of unmalleable iron of the firſt fuſion; divide it into ſmall parcels, and put them into a bed made of charcoal duſt in a ſmith's forge; let the quantity of the iron be but ſmall for the experiment; put to it, as a defenſive menſtruum, ſome of the vitreſcent ſcoriæ of ſand, or ſtones of the ſame nature; then put upon them a quantity of charcoal; light this, and admit only a ſmall blaſt of the bellows, that the ſcoriæ and metal may both melt

melt regularly: when this has been ſome time kept in fuſion, take it out, divide it into two parts, which make red-hot, and hammer into long bars; finally, heat them red-hot, and plunge them into cold water, and they will then be found to be ſteel, ſo very hard, as not to be filable; and ſo brittle, as to break aſunder, when ſtruck with a conſiderable force. *Cramer's Art of Aſſaying.*

Mr. Lemery ſhews a ſimple method of reducing ſteel to a very fine powder, without ruſting it: pour water on filings of ſteel in an earthen veſſel, till it is four inches above the filings; ſtir it well every day, ſupplying more water, as that in the veſſel ſubſides, ſo that the ſteel is always covered; continue this operation till the ſteel falls into an impalpable black powder; then dry it for uſe. *Mem. d l'Acad. des Scien.* 1736.

Mr. Boyle tells us of his having opened the body of ſteel, by a highly rectified ſpirit of urine made per ſe, and poured upon new filings of the ſteel. This being put into a warm place, the menſtruum diſſolved a conſiderable part of the metal. *Mem. de l'Acad. des Sciences*, 1736.

Annealing of STEEL, is by ſome uſed for the ſoftening it, in order to make it work eaſier; which is uſually done by giving it a blood-red heat in the fire, and then taking it out, and letting it cool of itſelf.

Steel may indeed be made a little ſofter than in the common way, by covering it with a coarſe powder of cow-horn, or hoofs; thus incloſing it in a loam, heating the whole in a wood fire till it be red-hot, and then leaving the fire to go out of itſelf, and then the ſteel to cool. *Mox. Mechan. Exerciſes.*

STEELING, in cutlery, the laying on a piece of ſteel upon a larger maſs of iron, to make that part which is to receive the edge harder than the reſt. The body of an axe may very well be of iron, as it never comes in uſe to cut with, and perhaps is ſtronger, and leſs liable to break than if of ſteel: but it muſt have a quantity of ſteel at that part where the edge is to be made.

STEEL-GLASSES, a name given by ſome authors to the metalline ſpheres uſed in optics. Theſe, according to Cardan, are made of three parts of braſs, one part of tin, and one of ſilver, with an eighteenth part of antimony; but moſt either totally leave out the ſilver, or add only a twenty-fourth part, to ſave the expence. There are many other methods directed by ſeveral authors, but moſt uſe arſenic and tartar mixed with the metals. Theſe are afterwards to be poliſhed with emery, rotten-ſtone, putty, and the like.

STEELYARD, *Statera Romana*, in mechanics, a kind of ballance by means of which the gravity of different bodies is found by the uſe of one ſingle weight. See BALLANCE.

STEEPLE, an appendage erected generally on the weſtern end of a church, to hold the bells. Steeples are denominated from their form, either ſpires or towers; the firſt are ſuch as aſcend continually diminiſhing either conically or pyramidally. The latter are more parallelopipeds, and are covered at the top platform-like.

In each kind there is uſually a ſort of windows or apertures to let out the ſound, and ſo contrived at the ſame time, as to drive it down.

STEGANOGRAPHY, the art of ſecret writing, or of writing in cyphers, known only to the perſons correſponding.

STEGNOTICS, in medicine, remedies proper to cloſe and ſtop the orifices of the veſſels, or emunctories, when relaxed, ſtretched, lacerated, &c.

The word is formed from the Greek, στεγω, to hinder, or cloſe.

STELLATE, among botaniſts, expreſſes leaves which grow not leſs than ſix at a joint, and are arranged like the rays of a ſtar.

STEM, in botany, that part of a plant ariſing out of the root, and which ſuſtains the leaves, flowers, fruits, &c.

STEMPLES, in mining, croſs bars of wood in the ſhafts which are ſunk to mines. In many places the way is to ſink a perpendicular hole or ſhaft, the ſides of which they ſtrengthen from top to bottom with woodwork, to prevent the earth from falling in; the tranſverſe pieces of wood uſed for this purpoſe, they call ſtemples, and by means of theſe the miners, in ſome places, deſcend without uſing any rope, catching hold of theſe with their hands and feet.

STENONIAN DUCT, or *Ductus ſalivus Stenonius*, in anatomy, a name given from Steno, its diſcoverer, to one of the ſuperior ſalival ducts, running from each of the parotids, about three fingers long, and of the thickneſs of a wheat ſtraw, having a great number of roots. This duct paſſes over the maſſeter muſcle through the middle of the cheek, and there perforates the buccinator muſcle, and the membrane of the mouth near the ſecond or third molares, and at this perforation it diſcharges a very large quantity of its proper fluid into the mouth.

STENTOROPHONIC TUBE, a ſpeaking trumpet, thus called from Stentor, a perſon mentioned by Homer. See TRUMPET.

STEP *and Leap*, in the manege, one of the ſeven airs or artificial motions of a horſe, conſiſting, as it were, of three airs, viz. the pace or ſtep, which is terra a terra; the raiſing, which is the curvet, and the whole finiſhed with a ſault or leap. The ſtep properly puts a horſe on the hand, and gives him a riſe to leap; like one that runs before he leaps, that he may go the higher or the farther. For leaps of all kinds, the rider is not to give any aids or helps with his legs, only to hold the horſe well up with the bridle-hand when he riſes before, that he may riſe the higher behind. When he begins to riſe behind, he is to put the bridle-hand a little forwards to hold him before, and ſtay him there on the hand as if he hung in the air, timing the motion of the bridle-hand ſo, as to make him like a ball on the bound, which is the great ſecret in leaping.

STEPHEN, or *St.* STEPHEN'S-DAY, a feſtival of the Chriſtian church, obſerved on the 26th of December, in memory of the firſt martyr St. Stephen.

STEREOGRAPHIC PROJECTION, is the projection of the circles of the ſphere on the plane of ſome one great circle, the eye being placed in the pole of that circle. The method and practice of this projection in all the principal places, viz. on the planes of the meridian, equinoctial, and horizon, have already been given under the articles MAP and PROJECTION.

STEREOGRAPHY, the art of drawing the forms and figures of the ſolids upon a plane.

STEREOMETRY, στερεομετρια, that part of geometry which teaches how to meaſure ſolid bodies, i. e. to find the ſolidity or ſolid content of bodies, as globes, cylinders, cubes, veſſels, ſhips, &c.

STEREOTOMY, the art or act of cutting ſolids, or making ſections thereof, as walls or other members in the profiles of architecture.

STERILITY, the quality of a thing that is barren, in oppoſition to fecundity.

The word is formed from the Latin *ſterilitas*, or *ſterilis*, barren.

STERLING, a term frequent in Engliſh commerce, a pound, ſhilling, or penny, of lawful money of England, as ſettled by public authority.

STERNOHYOIDÆUS, in anatomy, a pair of muſcles ariſing from the upper and internal part of the bone of the ſternum.

STERNUM, in anatomy, the breaſt-bone, is ſituated in the middle of the breaſt, and is compoſed of ſeven or eight bones in infants, which at firſt are cartilaginous, but which harden and unite into three bones after they are ſeven years old; the ſubſtance of theſe bones is not ſolid, but ſomewhat ſpongious. The firſt and uppermoſt is the biggeſt and largeſt; it is uneven and rough on the outſide, but ſmoother on its inſide, where it has a ſhallow furrow, which gives way for the deſcent of the windpipe. It has a ſinus lined with a cartilage on each ſide of its upper end, wherein it receives the heads of the claviculæ. The ſecond is longer and narrower than the firſt, and on its ſides, there are ſeveral ſinus's in which the cartilaginous ends of the ribs are received. The third is ſhorter, but broader than the ſecond. It receives into the lateral ſinus's the extremities of the laſt two ribs; it terminates in a cartilage which hardens ſometimes into a bone, called cartilago xiphoidis, or enſiformis, becauſ it is broac at its upper end, where it joins

joins the third bone, and grows narrower to its extremity, where it is ſometimes forked, and ſometimes it bends inwards, compreſſes the upper orifice of the ſtomach, and cauſes a great pain and vomiting. The uſe of the ſternum is to defend the heart, and to receive the extremities of the true ribs.

STERNUTATIVE, or STERNUTATORY, a medicine proper to produce ſneezing.

STEW, a ſmall kind of fiſh-pond, the peculiar office of which is to maintain fiſh, and keep them in readineſs for the daily uſes of a family.

STEWS, or STUES, were alſo places, anciently, permitted in England to women of profeſſed incontinency for the proffer of their bodies to all comers. They were under particular rules and laws of diſcipline, appointed by the lord of the manor.

STEWARD, an officer appointed in another's ſtead or place, and always taken for a principal officer within his juriſdiction, Of theſe there are various kinds. The greateſt officer under the crown is the lord high ſteward of England, an office that was anciently hereditary and permanent in the families of the dukes of Lancaſter, till the time of Henry IV. But the power of this officer is ſo very great, that it has not been judged ſafe to truſt it any longer in the hands of a ſubject, excepting only *pro hac vice*, occaſionally: as to officiate at a coronation, at the arraignment of a nobleman for high treaſon, or the like. During his office, the ſteward bears a white ſtaff in his hand, and the trial, &c. ended, he breaks the ſtaff, and with it his commiſſion expires. There is likewiſe a lord ſteward of the king's houſhold, who is the chief officer of the king's court, has the care of the king's houſe, and authority over all the officers and ſervants of the houſhold, except ſuch as belong to the chapel, chamber, and ſtable.

There is alſo a ſteward of the Marſhalſea, who has judicial authority. And in moſt corporations, and all houſes of quality in the kingdom, there is an officer of the name and authority of a ſteward.

The ſteward of a ſhip is he who receives all the victuals from the purſer, and is to ſee it well ſtowed in the hold; all things of that nature belonging to the ſhip's uſe are in his cuſtody; he looks after the bread, and diſtributes out the ſeveral meſſes of victuals in the ſhip; he hath an apartment for himſelf in the hold, which is called the ſteward's room.

STIGMATA, in natural hiſtory, the apertures in different parts of the bodies of inſects, communicating with the tracheæ, or air veſſels, and ſerving for the office of reſpiration. Nature has given to theſe minute animals a much larger number of tracheæ and bronchia than to us; all the two winged and four winged flies, which have a ſingle or undivided corcelet, to which their legs are all fixed, have alſo four ſtigmata in that corcelet, two on each ſide; they have them alſo on the rings of their body, but thoſe on the corcelet are the moſt conſiderable. Of the four on the corcelet, the two anterior ones are uſually the largeſt; theſe, as well as the poſterior ones, are oblong, and placed obliquely to the length of the body. The colour of the ſtigmata frequently differs from that of the corcelet; ſome are yellowiſh, others of a coffee-colour, or ſome degrees of a fallow colour, in flies whoſe corcelet is brown, black, or blue. Flies have, beſide theſe, ſeveral ſtigmata alſo in the rings of their bodies, perhaps in every one of them: theſe ſtigmata are not like thoſe of the corcelet, but are round, uſually a little eminent above the reſt of the ſurface, and reſembling a pin's head.

STIGMATA, in antiquity, certain marks impreſſed on the left ſhoulders of the ſoldiers when liſted.

STIGMATA were alſo kinds of notes or abbreviations, conſiſting only of points diſpoſed various ways, as in triangles, ſquares, croſſes, &c.

STIGMATIZING, among the antients, was inflicted upon ſlaves, as a puniſhment, but more frequently as a mark to know them by, in which caſe it was done by applying a red-hot iron marked with certain letters to their foreheads, till a fair impreſſion was made, and then pouring ink into their furrows, that the inſcription might be the more conſpicuous. Stigmatizing, among ſome nations, was, however, looked upon as a diſtinguiſhing mark of honour and nobility.

STIL *de Grain*, in the colour-trade, the name of a compoſition uſed for painting in oil or water, and is made by a decoction of the lycium or Avignon-berry in alum-water, which is mixed with whiting into a paſte, and formed into twiſted ſticks. It ought to be choſen of a fine gold-yellow, very fine, tender and friable, and free from dirt.

STILE, *Stilus*. See the article STYLE.

STILES, in carpentry, denote the upright pieces which go from the bottom to the top of any wainſcot, or the like.

STILLATITIOUS OILS, ſuch as are produced by diſtillation, in oppoſition to thoſe got by infuſion, expreſſion, &c.

STILL-BOTTOMS, in the diſtillery, a name given by the traders to what remains in the ſtill after the working the waſh into low wines. Theſe bottoms are procured in the greateſt quantity from the malt waſh, and are of ſo much value to the diſtiller, in the fattening of hogs, &c. that he often finds them one of the moſt valuable articles of the buſineſs.

The liquor left behind in the ſtill, after the rectifying the low wines into proof-ſpirit, is alſo called by ſome by the name of ſtill-bottoms; but this is little more than mere phlegm, or water impregnated with a few acid and oily parts, not worth ſeparating, unleſs for curioſity. The liquor left in the ſtill, after the rectifying the proof-ſpirit into alcohol, is alſo of the ſame kind.

The bottoms of melaſſes ſpirits ſeem calculated for many uſes. It is very probable that the vinegar-makers would find their account in the trying them; and the ſtrong and laſting yellow colour, with which they tinge the hands, may recommend them to the dyers. A ſmall proportion of them, added to the new treacle to be fermented, greatly promotes the operation, and increaſes the quantity of ſpirit.

The bottoms of the wine ſpirit, that is, the remainder, after diſtilling the ſpirituous part from damaged wines, or wine lees, may be brought to afford Mr. Boyle's acid ſpirit of wine, and that ſubſtance called by Becher the *media ſubſtantia vini*. A parcel of tartar may alſo be procured in very great perfection; and the laſt remainder may be converted into excellent and genuine ſalt of tartar. This liquor may likewiſe be ſerviceable in making vinegar and white lead.

STILL-HOUSE. The Dutch have much the advantage of us in the ſtructure of their ſtill-houſes. The general rules in building thoſe houſes, according to Shaw, ſhould be ſuch as follow. The firſt caution is, to lay the floor aſlope, not flat, where any wet work is to be performed. It ſhould alſo be well flagged, with broad ſtones, ſo that no wet be detained in the crevices, but all may run off, and be let out at the drains made at the bottom and ſides. The ſtills ſhould be placed abreaſt on that ſide of the ſtill-houſe to which the floor has its current. Fronting the ſtills, and adjoining to the back of the wall ſhould be a ſtage for holding the fermenting backs, and theſe being placed at a proper height, may empty themſelves by means of a cock and a canal into the ſtills, which are thus charged with very little trouble. Near this ſet of fermenting backs ſhould be placed a pump or two, that may readily ſupply them with water, by means of a trunk, or canal, leading to each back; under the pavement adjoining to the ſtills ſhould be a kind of cellar, wherein to lodge the receivers, each of which ſhould be furniſhed with its pump, to raiſe the low wines into the ſtill for rectification; and through this cellar the refuſe waſh, or ſtill bottoms, ſhould be diſcharged by means of a hoſe, or other contrivance.

STIMULATING, *Stimulans*, a property in angular or ſharp bodies, whereby they vellicate and cauſe vibrations and inflections of the fibres of the nerves, and a greater derivation of nervous fluid into the parts affected. Stimulants produce pain, heat, redneſs, &c. They may be reduced to violent penetrating depilatories, gentle ſinapiſms, veſicatories, and cauſtics.

STING, *Aculeus*, an apparatus in the body of certain inſects, in form of a little ſpear, ſerving them as a wea-

pon of offence. The ſting of a bee or waſp, is a curious piece of mechaniſm; it conſiſts of a hollow tube, at the root whereof there is a bag full of ſharp, penetrating juice, which in ſtinging, is injected into the fleſh, through the tube; within the tube, Mr. Durham has obſerved, there lie two ſharp ſmall bearded ſpears: in the ſting of a waſp, he told eight beards on the ſide of each ſpear ſomewhat like the beards of fiſh-hooks. One of theſe ſpears in the ſting, or ſheath, lies with its point a little before the other, to be ready, as ſhould ſeem, to be firſt darted into the fleſh, which once fixed by means of its foremoſt beard, the other then ſtrikes too, and ſo they alternately pierce deeper and deeper, their beards taking more and more hold in the fleſh; after which the ſheath or ſting follows to convey the poiſon into the wound, which that it may pierce the better, is drawn into a point with a ſmall ſlit below that point for the two ſpears to come out at. By means of theſe beards it is, that the animal is forced to leave its ſting behind it, when diſturbed, becauſe it can have no time to withdraw the ſpears into the ſcabbard.

STINK, or STENCH, a diſagreeable ſmell exhaling from a corrupted, or other body, and which is prejudicial to the noſe and brain. A ſtinking breath is uſually the reſult either of diſeaſed lungs, or elſe of ſcorbutic gums, &c. A ſtinking noſe is the reſult of a deep ulcer within the noſe, whence ariſe fetid ſcales, &c.

STIPEND, *Stipendium*, among the Romans, ſignified the ſame with tribute; and hence ſtipendiarii were the ſame with tributarii.

STIPULATION, in the civil law, the act of ſtipulating, that is, of treating and concluding terms and conditions to be inſerted in a contract. Stipulations were anciently performed at Rome, with abundance of ceremonies; the firſt whereof was, that one party ſhould interrogate, and the other anſwer, to give his conſent, and oblige himſelf. By the ancient Roman law, no body could ſtipulate but for himſelf; but as the tabelliones were public ſervants, they were allowed to ſtipulate for their maſters, and the notaries, ſucceeding the tabelliones, have inherited the ſame privilege.

STOCKING, that part of the cloathing of the leg and foot which immediately covers their nudity, and ſkreens them from the cold.

Anciently, the only ſtockings in uſe were made of cloth or milled ſtuff ſewed together; but ſince the invention of knitting and weaving ſtockings of ſilk, wool, cotton, thread, &c. the uſe of cloth ſtockings is quite laid aſide.

The modern ſtockings, whether wove or knit, are a kind of plexus's formed of an infinite number of little knots, called ſtitches, loops, or maſſes, intermingled in one another.

Knit ſtockings are wrought with needles made of poliſhed iron or braſs wire, which interweave the threads and form the maſſes the ſtocking conſiſts of. This operation is called knitting, the invention of which is commonly attributed to the Scots, on this ground, that the firſt works of this kind came from thence. It is added, that it was on this account that the company of ſtocking-knitters eſtabliſhed at Paris, in 1527, took for their patron St. Fiacre, who is ſaid to be the ſon of a king of Scotland. Woven ſtockings are ordinarily very fine; they are manufactured on a frame, or machine of poliſhed iron, the ſtructure and apparatus of which being exceedingly ingenious, are repreſented in plate CXXIII. *fig.* 1. where A is the jack for the bobbins to turn upon; B is the ſizer, or woman whoſe buſineſs it is to twiſt the threads as they ſhall beſt ſuit the frame, in which the work is to be performed; C, the rices which wind the hanks or ſkains upon the bobbins for the uſe of the ſizer; D, the winder; and E the ſtocking-frame, or engine, with the maker at work. 1. Are the treddles, like thoſe of other ſorts of looms; 2. is the bobbin of twiſted ſilk, &c. fixed on the bobbin-wire, which it turns with eaſe to feed the engine; 3. is the wheel, by whoſe motion the jacks are drawn together upon the needles; 4. is the ſilk, &c. which runs off the bobbin, and is in that poſture directed up to the needle to be looped; 5. is the needle on which the ſtockings are made according to art.

The Engliſh and French have greatly conteſted the honour of the invention of the ſtocking-loom; but we are aſſured, whatever pretenſions the French claim to this invention, that the ſame was certainly deviſed by William Lee, of St. John's college, Cambridge, in the year 1589, though it is true, that he firſt made it public in France, after deſpairing of ſucceſs in his own country.

STOICS, a ſect of antient philoſophers, the followers of Zeno, thus called from the Greek, στοα, which ſignifies a porch or portico, in regard Zeno uſed to teach under a portico or piazza.

It was the common fault of the Stoics to introduce abundance of ſubtilty and dryneſs into their diſputations, either by word of mouth, or in writing. They ſeemed as carefully to avoid all beauty of ſtile, as depravity of morals. Chryſippus, who was one of the Stoics, did no great honour to his ſect, and could only diſgrace it. He believed the gods periſhable, and maintained, that they would actually periſh in the general conflagration. He allowed the moſt notorious and moſt abominable inceſts, and admitted the community of wives amongſt ſages.

To the praiſe of the Stoics in general, it muſt, however, be confeſſed, that, leſs intent than other philoſophers upon frivolous, and often dangerous ſpeculations, they devoted their ſtudies to the clearing up of thoſe great principles of morality which are the firmeſt ſupports of ſociety; but the dryneſs and ſtiffneſs that prevailed in their writings, as well as in their manners, diſguſted moſt of their readers, and abundantly leſſened their utility. Zeno's chief followers, among the Greeks, were Lucippus, Cleanthus, Chryſippus, Diogenes Babylonius, Antipater, Panætius, Poſſidonius, and Epictetus. Among the Romans, Cato, Varro, Cicero, Seneca, the emperor Antoninus, &c. The Stoics cultivated logic, phyſics, metaphyſics, &c. but eſpecially ethics. The principal of their dogmata, of the former kinds, are, that there are certain catalepſias or comprehenſions, called alſo κοινας εννοιας, innate ideas or principles, naturally found in the mind; that God is the ſeminal cauſe of the univerſe, and with the Platoniſt, that the world is an animal, by reaſon of God's inhabiting and informing every part thereof; that nature is an artificial fire tending to generation; and that the world is at laſt to be deſtroyed by a conflagration. As for the morality of the Stoics, it was couched much in paradoxes; as that a wiſe man is void of all paſſions, or perturbation of mind; that pain is no real evil, but that a wiſe man is happy in the midſt of torture, is always the ſame, and is always joyful; that there is none elſe free; that none elſe ought to be eſteemed king, magiſtrate, poet, or philoſopher; that all wiſe men are great men; that they are the only friends or lovers; that nothing can happen to them beyond their expectations; that all virtues are inſenſibly connected together; that all good things are equal, and equally to be deſired; that goodneſs admits of no increaſe or diminution. They own but one God, whom they, however, call by various names, as Fate, Jupiter, &c. by which they did not mean various things, but various powers and relations of the ſame thing. Providence they expreſſed under the name Fate, which Chryſippus defines to be a natural ſeries, or compoſition of things mutually following each other, by an immutable nexus, or tie, fixed from all eternity. They held the immortality of the ſoul.

STOLE, *Stola*, a ſacerdotal ornament wore by the Romiſh pariſh prieſts over their ſurplice, as a mark of ſuperiority in their reſpective churches; and by other prieſts, over the alb, at celebrating of maſs, in which caſe it goes a croſs the ſtomach; and by deacons, over the left ſhoulder, ſcarf-wiſe; when the prieſt reads the Goſpel for any one, he lays the bottom of his ſtole on his head. The ſtole is a broad ſwath, or ſlip of ſtuff hanging from the neck to the feet, with three croſſes thereon. The biſhops anciently pretended, that the pariſh-prieſts were never to appear before them, but in their ſtole. In Flanders and Italy, they always preach in ſtoles; it is ſuppoſed to be a repreſentation of the extremities of the long robe, wore by the high-prieſt of the Jews.

Groom of the STOLE, the eldeſt gentleman of his majeſty's bed-chamber, whoſe office and honour it is to preſent and put on his majeſty's firſt garment, or ſhirt, every morning, and to order the things in the chamber.

Order of the STOLE, an order of knights inſtituted by the kings of Arragon. Another military order, at Venice, is called the order of the golden ſtole; thus called from a golden ſtole, which thoſe knights wore over their ſhoulder, reaching to the knee, both before and behind, a palm and a half broad. None are raiſed to this order but patricians, or noble Venetians. It is uncertain when either of theſe orders was inſtituted.

STOMACH, *Ventriculus*, in anatomy, a hollow, membraneous, organical part of an animal, deſtined to receive the food, after deglutition, and convert it into chyle.

It lies immediately under the midriff, the liver covers a part of its right ſide, the ſpleen touches it on the left, and the colon at its bottom, to which alſo the cawl is tied. Its figure reſembles a bag-pipe, being long, large, wide, and pretty round at the bottom, but ſhorter and leſs convex on its upper part, where it has two orifices, one at each end, which are ſomewhat higher than the middle between them. The left orifice is called καρδια, to which the œſophagus is joined. By this orifice the aliments enter the ſtomach, where being digeſted, they aſcend obliquely to the pylorus, or right orifice, which is united to the firſt of the inteſtines. At this orifice the tunicles of the ſtomach are much thicker than they are any where elſe, and the inmoſt has a thick and ſtrong duplicature, in form of a ring, which ſerves as a valve to the pylorus, when it contracts and ſhuts. The ſtomach is compoſed of four membranes or coats. The firſt and inmoſt is made of ſhort fibres, which ſtand perpendicularly upon the fibres of the next coat: they are to be ſeen plainly towards the pylorus. When the ſtomach is diſtended with meat, theſe fibres become thick and ſhort. Whilſt they endeavour to reſtore themſelves by their natural elaſticity, they contract the cavity of the ſtomach for the attrition and expulſion of the aliments. This coat is much larger than the reſt, being full of plaits and wrinkles, and chiefly about the pylorus: theſe plaits retard the chyle, that it run not out of the ſtomach before it be ſufficiently digeſted. In this coat there are, alſo, a great number of ſmall glands, which ſeparate a liquor which beſmears all the cavities of the ſtomach, and helps the concoction of the aliments; therefore, this coat is called tunica glanduloſa. The ſecond is much finer and thinner; it is altogether nervous; it is of an exquiſite ſenſe, and is called nervoſa. The third is muſcular, being made of ſtraight and circular figures; the ſtraight run upon the upper part of the ſtomach, between its ſuperior and inferior orifices; and the circular run obliquely from the upper part of the ſtomach, to the bottom. Of theſe, the innermoſt deſcend towards the right ſide, and the outermoſt towards the left; ſo that by their action both ends of the ſtomach are drawn towards its middle, and the whole is equally contracted; by their contraction and continual motion, the attrition and digeſtion of the aliments is in a great meaſure performed. The fourth tunicle is common, it comes from the peritonæum. The ſtomach ſends veins to the porta, viz. the gaſtrica, pylorica, and vas breve, and branches to the gaſtro-epiplois dextra and ſiniſtra, which are accompanied with branches of the arteria cæliaca, all which lie immediately under the fourth coat of the ſtomach. The eighth pair of nerves, or par vagum, give two conſiderable branches to the ſtomach, which, deſcending by the ſides of the gullet, divide each into two branches, the external and internal. The two external branches unite in one, and the internal do ſo likewiſe; both which piercing the midriff, form, by a great number of ſmall twigs, upon the upper orifice of the ſtomach and plexus, and then the internal branch ſpreads itſelf down to the bottom of the ſtomach; and the external branch ſpreads itſelf upon the inſide about the upper orifice of the ſtomach. This great number of nerves which is about the upper orifice renders it very ſenſible, and from them alſo proceeds the great ſympathy between the ſtomach, head, and heart; upon which account Van Helmont thought that the ſoul had its ſeat in the upper orifice of the ſtomach. The plexus nervoſi of the hypochondria and meſenterium give ſeveral branches to the bottom of the ſtomach; therefore in hyſteric and hypochondriac paſſions the ſtomach is alſo affected.

STOMACHICS, are ſuch medicines as are ſerviceable to the ſtomach, promote digeſtion, &c.

Stomachic corroboratives are ſuch as ſtrengthen the tone of the ſtomach and inteſtines, among which are carminatives, as the roots of galangals, red gentian, zedoary, pimpinella, calamus aromaticus, and arum. Of barks and rinds, thoſe of canella alba, ſaſſafras, citrons, Seville and China oranges, &c. Of ſpices, pepper, ginger, cloves, cinnamon, cardamums, and mace. Other things of this nature are, among ſimples, Roman and common chamæmile, wormwood, mint, carduus benedictus, and the four carminative ſeeds. Of preparations, the oil of cedar, oil of oranges by expreſſion, oils of common chamæmile, daucus Creticus, aniſum ſtellatum, cumin, caraway, mint, and wormwood, with the ſpirit of ſalt and ſweet nitre. Among compounds, are the ſal volatile ſylvii, the ſtomachic elixir, the eſſence of orange peel, with ſweet ſpirit of nitre, tincture of tartar, oils of oranges prepared by expreſſion, the compound eſſence of wormwood, &c.

STOMACHIC, is alſo applied to the arteries, veins, &c. of the ſtomach.

STOMACHUS, in anatomy, the ſame with the oeſophagus, or gula. See OESOPHAGUS.

STOMATIA, in natural hiſtory, a genus of ſimple ſhells, without any hinge, and formed of one piece; its figure is depreſſed and flat, its mouth the moſt patent of all the ſhells, the limpet only excepted; it has a ſhort ſpiral turn running into the mouth, at the head; and has no perforations in any part of the ſurface. The animal inhabiting this ſhell is a nereis.

STOMATICA, a term uſed by ſome for all medicines uſed in diſorders of the mouth and fauces.

STONE, in natural hiſtory, a hard ſolid body, neither malleable, fuſible by fire, nor ſoluble in water; formed, by ſucceſſion of time, in the bowels of the earth.

Mr. Tourneſort ſuppoſes that ſtones vegetate; but M. Geoffroy accounts for the origin and formation of ſtones in a different manner. He lays it down as a principle, that all ſtones, without exception, have been fluid; or, at leaſt, a ſoft paſte, now dried and hardened.

On this principle he examines the formation of the different kinds of ſtones, and ſhews that the earth alone is ſufficient for the ſame, independent of all ſalts, ſulphurs, &c. Mr. Geoffroy conceives two kinds of primitive particles in the earth. Thoſe of the firſt kind exceedingly fine, thin lamellæ, equal to each other, or nearly ſo. Now when theſe meet together, from any cauſe whatever, in a ſufficient quantity, the regularity and equality of their figures determine them to range themſelves equally and regularly; and thus to form a homogeneous compound, which is very hard, from the immediate contact of the parts; and very tranſparent, by reaſon of their regular diſpoſition, which leaves a free paſſage to the rays of the light every way; and this is called cryſtal.

The parts of the ſecond kind have all ſorts of irregular figures, and muſt accordingly form aſſemblages that are much opaquer, and leſs hard. Now cryſtal is formed wholly of parts of the firſt kind, and all other ſtones of a mixture of the two kinds of parts together; this mixture is abſolutely neceſſary, in order to unite and bind together the parts of the ſecond kind, and give them a hardneſs and conſiſtence, without which they would only make a ſand or duſt. Water appears the fitteſt vehicle, to carry the parts of the firſt kind. This is ſeen from ſeveral petrifying ſprings, which incruſtate the pipes through which their waters are conveyed, or even ſolid bodies laid in them for ſome time. The water does not diſſolve theſe earthy parts; it only keeps them in fuſion, as it does the juices wherewith plants are nouriſhed.

This water, thus charged with earthy particles of the firſt kind, M. Geoffroy calls the ſtony, or cryſtalline juice, of which thoſe bodies are primarily formed.

STONE, in medicine, a ſtony or terreſtrial concretion in any of the urinary paſſages, which occaſions a difficulty in making water, and a pain in the ſmall of the back, or about the os pubis. When this collection is ſo large as to form one or more bodies, unable by reaſon of their ſize to paſs through the conduits of urine, they frequently cauſe great pain, ulcers in the parts, and an intire ſuppreſſion of urine; and, from the part where this obſtructing matter happens to lodge, this diſtemper receives its denomination, as from the kidneys, bladder, ureters, or urethra.

This diſorder, ſays Dr. Shaw, may ſometimes have an hereditary cauſe; that is, the urinary paſſages may be naturally ſtraighter than they ought to be; or the conſtitution may be naturally diſpoſed to generate a ſtony matter; an obſtructed perſpiration, and a cold or moiſt air, may alſo give riſe to it; for by means hereof the more heavy particles of the animal fluids will be detained in the body.

Another occaſion of this diſtemper may be the uſe of ſuch waters, as by running through various ſtrata of the earth, are impregnated with ſtony particles. There are ſome wines too, and other liquors, which being either foul or not ſufficiently fined down, or abounding in tartar, or other terreſtrial corpuſcles, may lay the foundation for the ſtone. Again, in perſons ſubject to the aſthma or gout, who have a weak digeſtion, viſcid chyle, and ſtony concretions in the joints, there are manifeſt ſeeds of this diſtemper. In ſhort, whatever can bring on an accumulation of earthy particles in the urinary paſſages, whether by obſtructing or leſſening the capacity of the canals, or by immediately or remotely producing the ſubſtance itſelf, will cauſe gravel, and in time the ſtone.

The ſymptoms of the gravel or ſtone are, frequently, a nauſea and vomiting, with a numbneſs down the leg and thigh of the part affected; a pain fixed or moveable, great or leſs, in proportion to the bulk of impacted matter felt generally about the region of the loins, os pubis, and parts adjacent. This pain is very acute, and almoſt continual, when the gravel or ſtone remains at the head of the ureters; but begins to leſſen, as it is protruded forwards. Sometimes when the ſtone is angular, or continues long fixed, the urine is bloody; and, generally in nephritic obſtructions, it is thin, and made in a ſmall quantity, eſpecially at the beginning of the fit. Sometimes there happens a total ſuppreſſion of it, in which caſe both the ureters may be obſtructed.

When the obſtructed matter is forced into the bladder, the urine is turbid, and comes away plentifully: and there appears in it much ſand, and ſometimes ſmall ſtones; which when angular, are ſeldom voided without much pain; and when the paroxyſm is violent, and of long continuance, there ſometimes happens an entire ſuppreſſion of ſtool ſo far, that cathartics loſe their force; and ſometimes too, though rarely, the terreſtrial matter is depoſited in ſuch parts where the canals are lax and the circulation languid, ſo as at the ſame time to occaſion both an arthritic and a nephritic fit. When a ſtone is lodged in the urethra, the pain generally proves exquiſite, but limited to the part, where ſometimes the ſtone will bulge outwards, and may be felt with the fingers.

All paroxyſms, in caſe of a confirmed ſtone, are dangerous. An accumulation of ſand in the kindeys or ureters, is leſs dangerous than a formed ſtone. A ſtone in the kidneys is of a worſe conſequence than in the ureters, and more or leſs ſo in proportion to its bigneſs. The largeſt ſtone, naturally capable of paſſing the urethra in men, is ſuppoſed to be about the ſize of a ſmall hazel nut; but in women, one conſiderably larger may paſs the meatus urinarius. When both kidneys, or both ureters, are affected, it is ſo much the more dangerous, eſpecially if attended with ſharp pain, exulceration, inflammation, want of ſleep, loſs of ſtrength, a fever, ſuppreſſion of urine, &c. When the ſymptoms continue many days without intermiſſion, the caſe is deſperate; eſpecially if coldneſs has ſeized the extremities, the pulſe ticks, and the patient has cold ſweats, &c. When the caſe is habitual or hereditary, or happens in old age or gouty conſtitutions, it is difficult. The ſymptoms of bloody urine, continuing after the fit is gone off, prove hard to remove. When the urine is plentifully diſcharged, has its ordinary ſediment, is turbid, and the ſymptoms decreaſe, it is a ſign the paroxyſm is going off. If a large ſtone be long detained in the urethra, eſpecially if it be rugged, and can neither be propelled backwards nor forwards, and there be a total ſuppreſſion of urine, the caſe uſually proves mortal.

As to the method of cure, it conſiſts in the eaſy excluſion of the ſtone, and the preventing the breeding of others. To this purpoſe, Sydenham recommends bleeding, a poſſet-drink, in which two ounces of marſh-mallow roots have been boiled, and an emollient clyſter; after which, he adviſes a pretty large doſe of an opiate; that is, about twenty-five drops of the thebaic tincture, or fifteen grains of the ſaponaceous pills. And Huxham tells us, that nothing is ſo efficacious to eaſe the pain, and promote the deſcent of the ſtone through the ureters, as a tepid and emollient bath. Dr. Mead aſſures us, that it is an error in practice, to give ſtrong forcing diuretics, with a view of driving out the gravel with the urine: whereas this intention is anſwered with greater ſafety, in moſt caſes, by relaxing and lubricating medicines; eſpecially if, in caſe of violent pain, bleeding be premiſed, and anodynes interſperſed. He therefore adviſes, to give three or four grains of opium, diſſolved in five or ſix ounces of the common decoction, by way of clyſter. However, he allows, there are conjunctures, after the pain is abated, when powerful diuretics may be adminiſtered; but with this precaution, that as ſoon as they have had their effect, they are no longer to be continued. All this time the body ſhould be kept open, by giving a turpentine clyſter, and ſometimes purging gently with an infuſion of ſena and manna, becauſe ſtrong cathartics are to be avoided.

The chief lubricating medicines are oil of ſweet almonds, ſyrup of marſh-mallows, emulſions made with almonds, and the like; to which may be added the uſe of the warm bath. Soap and lime-water are alſo celebrated lithontriptics.

Such as have a ſtone in the bladder, ſhould, while they are taking the foreſaid medicines, have four ounces or upwards of tepid oyſter ſhell lime-water injected into the bladder every day; taking care to evacuate their urine before injection, and to retain it as long as they can without pain. And were it not for the trouble of introducing the catheter, the injection might be made at leaſt twice every day; and if a flexible catheter were always kept in the bladder, it might be done at pleaſure, and the diſſolution of the largeſt ſtone quickly procured. The lime-water will be ſafer, and yet loſe nothing of its virtue, if a dram of ſtarch, or the fourth part of the yolk of an egg, be boiled in ſix or ſeven ounces of it.

Thoſe who, though they have no ſtone in the bladder, are nevertheleſs frequently troubled with fits of the gravel in the kidneys, may probably put a ſtop to the diſorder, by drinking every morning a pint of oyſter-ſhell lime-water, two or three hours before breakfaſt. Its diſagreeable taſte may be mitigated, by adding a very ſmall quantity of new-milk to it; alſo a dram and a half, or two drams, of juniper-berries, infuſed in every quart-bottle of it, will mend its taſte much.

As to the regimen to be obſerved, Dr. Mead recommends a mild diet, and ſuch as is eaſy of digeſtion; and wine and water, mead, or new ſoft ale, for drink; and gentle exerciſe, eſpecially riding.

STONE alſo denotes a certain quantity or weight of ſome commodities.

A ſtone of beef at London, is the quantity of eight pounds; in Herefordſhire twelve pounds; in the north, ſixteen pounds.

A ſtone of wool, according to the ſtatute of 11 Hen. VII. is to weigh fourteen pounds; yet in ſome places it is more, in others leſs; as in Glouceſterſhire fifteen pounds; in Herefordſhire twelve pounds.

A ſtone among horſe-courſers, is the weight of fourteen pounds.

STONEHENGE, in antiquity, a famed pile or monument

ſtument of huge ſtones in Saliſbury plain, ſix miles diſtant from that city. It conſiſts of the remains of four ranks of rough ſtones, ranged one within another, ſome of them, eſpecially in the outermoſt and third rank, twenty feet high, and ſeven broad; ſuſtaining others laid acroſs their heads and faſtened by mortiſes: ſo that the whole muſt have anciently hung together.

Antiquaries are now pretty well agreed that it was a Britiſh temple; and Dr. Langwith thinks it might eaſily be made probable at leaſt, it was dedicated to the ſun and moon. Inigo Jones has given a fine ſcheme of the work, and ſtrives hard to perſuade the world, that it was Roman: but Dr. Langwith, who took his meaſures on the ſpot, aſſures us he could by no means reconcile them with that ſcheme.

STONE BRASH, in agriculture, is a light lean ſoil, full of larger and ſmaller maſſes of rubble ſtones.

Theſe are to be tilled according to the condition in which they are found, for if they are graſſy they fallow them pretty late; but, if they have no graſs upon them, they fold them in winter, when the ſheep's dung, with the help of ſome hay-ſeed, will furniſh them with graſs; or elſe, early in the ſpring, they lay upon them old thatch or ſtraw, or the ſtrawy part of old dunghills, earth out of ditches, or the like, which will all, more or leſs, help forward a coat of graſs upon the land; for it is a rule, in regard to theſe lands, that they muſt have a covering of graſs before they are fallowed, elſe they will yield but a poor crop.

STONY-LANDS, in agriculture, ſuch as are full of flints, pebbles, or ſmall fragments of free-ſtone.

Theſe lands in many places yield good crops, and the general rule is, that in ſtiff and cold lands the ſtones ſhould be as carefully picked out as may be, but in light and dry grounds they ſhould be left. In Oxfordſhire they have great quantities of a lean earth, and a ſmall rubble-ſtone, or a four ſort of land mixed with it; this is ſometimes very full of weeds, and ſometimes very clear of them: if they are weedy, they fallow them late; but if they be ſeary, as they expreſs it, that is, if they have ſward upon them, they either fold them in winter, and add ſome hay-ſeed to the ſheep's dung, to bring up graſs; or elſe they lay old thatch, or ſtraw, and dung upon it; for they reckon, that if theſe lands have no ſward upon them before they are fallowed, they will by no means be brought to bear a good crop, but a great deal of May-weed, and other improfitable herbs. In September, November, and December, they fallow as the ſward directs them: if this is done in either of the two laſt months, they call it a winter fallowing, and never ſtir it again till they plough it, and ſow it with barley; and theſe lands are reckoned to do better than if finely tilled. They will bear wheat and meſlin in a kindly year, and large crops of barley, if they are well managed, and kept in good heart.

They always fallow theſe lands every other year, unleſs they ſow peaſe upon them; ſometimes they ſow them with lentils; and, when they are quite worn out, they lay them down for clover, or rye-graſs.

STOOMING *of Wine*, is the putting bags of herbs, or other ingredients, into it. See WINE.

STOOPING, in falconry, is when a hawk being upon the wing, at the height of her pitch, bends down violently to take the fowl.

STOP, in the manege, is a pauſe, or diſcontinuance of a horſe's motion.

To form a ſtop, you muſt, in the firſt place, bring to the calves of your legs to animate him, bend your body backwards, raiſe the bridle-hand without moving the elbow, then vigorouſly extend your hams, and reſt upon your ſtirrups, and make him form the times or motions of his ſtop, in falcading his haunches three or four times. After ſtopping your horſe, make him give three or four curvets. The oppoſite term of ſtop, is parting. In former times, the ſtop of a horſe was called parade.

Half a ſtop, is a ſtop not finiſhed, but a peſate; ſo that the horſe, after falcading three or four times upon the haunches, reſumes and continues his gallop, without making peſades or corvets.

STOPS, or POINTS, in grammar. See the articles POINTING and PUNCTUATION.

STORAX, or STYRAX, in the materia medica, an odoriferous reſin exuding in the warmer climates, from a middling ſized tree, with leaves like thoſe of the quince, flowers like thoſe of the orange tree, and fruit like filberds; a native of Aſia, and, as it is ſaid, of Italy. Two ſorts of this reſin have been commonly diſtinguiſhed in the ſhops.

1. Storax in the tear, not in ſeparate tears, or exceeding rarely, but in maſſes, ſometimes compoſed of whitiſh and pale reddiſh brown tears, and ſometimes of an uniform reddiſh-yellow or browniſh appearance; unctuous and ſoft like wax, and free from viſible impurities. This is ſuppoſed to be the ſort which the ancients received from Pamphylia in reeds or canes, and which was thence named calamita.

2. Common ſtorax, in large maſſes, conſiderably lighter and leſs compact than the foregoing, and having a large admixture of woody matter like ſaw-duſt. This appears to be the kind intended by the London college, as they direct their ſtyrax calamita to be purified, for medicinal uſe, by ſoftening it with boiling water, and preſſing it out from the fœces betwixt warm iron plates; a proceſs which the firſt ſort does not ſtand in need of. And indeed there is rarely any other than this impure ſtorax to be met with in the ſhops.

The writers on the materia medica in general prefer the pure ſtorax in the tear, and reject that which is mixed with woody matter. It appears however, upon compariſon, that this laſt, notwithſtanding its large proportion of impurities, is the moſt fragrant of the two: nor is it difficult to aſſign a reaſon for this ſuperiority, as the pure juice muſt have required, for its inſpiſſation to a firm conſiſtence, a longer expoſure to the ſun and air, and conſequently loſt more of its volatile parts, than when abſorbed and thickened by the woody ſubſtance.

Common ſtorax, infuſed in water, imparts to the menſtruum a gold yellow colour, ſome ſhare of its ſmell, and a ſlight balſamic taſte. It gives a conſiderable impregnation to water by diſtillation, and ſtrongly diffuſes its fragrance when heated, though it ſcarcely yields any eſſential oil. Hence, in the purification of it by ſtraining, it is apt to ſuffer a conſiderable loſs of its finer matter, which is partly diſſipated by the heat, and partly kept diſſolved by the water: a part of the ſtorax is likewiſe defended by the woody ſubſtance from the action of the preſs, and left behind among the fœces. It may be purified rather more elegantly by means of rectified ſpirit, which readily diſſolves the fine reſin, leaving only the impurities and a little inert gummy matter: the ſpirit gently diſtilled off from the filtered reddiſh-yellow ſolution, brings over with it very little fragrance of the ſtorax; and the remaining is more fragrant than the fineſt ſtorax in the tear which we have met with. The pure reſin, diſtilled without addition, yields, along with an empyreumatic oil, a portion of ſaline matter ſimilar to the flowers of benzoine, and ſometimes alſo a ſubſtance has been extracted from it of the ſame nature by coction in water.

Storax is one of the moſt agreeable of the odoriferous reſins, of a mild taſte, of no great heat or pungency, nearly ſimilar, in its medical as in its pharmaceutic qualities, to benzoine and balſam of Tolu. It is not, however, much uſed in common practice, unleſs as an ingredient in ſome of the old compoſitions, and in an opiate pill to which it gives name in the ſhops.

Liquid STORAX, a reſinous juice, obtained from a large tree, with angular leaves like thoſe of the maple, and a round fruit compoſed of a number of pointed ſeed-veſſels, called by Ray *ſtyrax aceris folio*, a native of Virginia and Mexico, and lately naturalized to our own climate. The juice called liquid amber is ſaid to exude from inciſions made in the trunk of this tree, and the liquid ſtorax to be obtained by boiling the bark or branches in water.

Two ſorts of liquid ſtorax are diſtinguiſhed by authors: one, the purer part of the reſinous matter that riſes to the ſurface in the boiling, ſeparated by a ſtrainer, of the conſiſtence of honey, tenacious like turpentine, of a reddiſh or aſh-brown colour, of an acrid unctuous taſte, and a fragrant ſmell, reſembling that of the ſolid ſtorax, but

but ſomewhat diſagreeable: the other, the more impure part, which remains on the ſtrainer, in ſmell and taſte much weaker, and containing a conſiderable proportion of the ſubſtance of the bark. What is moſt commonly met with under the name in the ſhops, is of a weak ſmell, and a grey colour, and is ſuppoſed to be an artificial compoſition.

STORGE, στοργη, a Greek term, frequently uſed for the parental inſtinct, or natural affection, which almoſt all animals bear their young; whereby they are moſt powerfully moved to defend them from dangers, and procure for them ſuitable nouriſhment.

STOVES, in gardening, are buildings erected for the preſervation of tender exotic plants, which will not live in theſe northern countries, without artificial warmth in winter. Theſe are built in different methods, according to the ingenuity of the artiſt, or the different purpoſes for which they are intended; but in England they are at preſent reducible to two.

The firſt is called a dry ſtove, being ſo contrived, that the flues through which the ſmoke paſſes are either carried under the pavement of the floor, or elſe are erected in the back-part of the houſe, over each other, and are returned ſix or eight times the whole length of the ſtove. In theſe ſtoves the plants are placed on ſhelves of boards laid on a ſcaffold above each other, for the greater advantage of their ſtanding in ſight, and enjoying an equal ſhare of light and air. In theſe ſtoves are commonly placed the tender ſorts of aloes, cereus's, euphorbiums, tithymals, and other ſucculent plants, which are impatient of moiſture in winter; and therefore require, for the moſt part, to be kept in a ſeparate ſtove, and not placed among trees, or herbaceous plants, which perſpire freely, and thereby often cauſe a damp air in the houſe, which is imbibed by the ſucculent plants, to their no ſmall prejudice.

Theſe ſtoves may be regulated by a thermometer, ſo as not to over-heat them, nor to let the plants ſuffer by cold; in order to which, all ſuch plants, as require nearly the ſame degree of heat, ſhould be placed by themſelves in a ſeparate houſe; for, if in the ſame ſtove there are plants placed of many different countries, which require as many different heats, by making the houſe warm enough for ſome plants; others, by having too much heat, are drawn and ſpoiled.

The other ſorts of ſtoves are commonly called bark ſtoves, to diſtinguiſh them from the dry ſtoves already mentioned. Theſe have a large pit, nearly the length of the houſe, three feet deep, and ſix or ſeven feet wide, according to the breadth of the houſe; which pit is filled with freſh tanners bark, to make an hot-bed; and in this bed the pots of the moſt tender exotic trees, and herbaceous plants, are plunged: the heat of this bed being moderate, the roots of the plants are always kept in action; and the moiſture, detained by the bark, keeps the fibres of their roots in a ductile ſtate, which, in the dry ſtove, where they are placed on ſhelves, are ſubject to dry too faſt, to the great injury of the plants. In theſe ſtoves, if they are rightly contrived, may be preſerved the moſt tender exotic trees and plants, which, before the uſe of the bark was introduced, were thought impoſſible to be kept in England; but, as there is ſome ſkill required in the ſtructure of both theſe ſtoves, we ſhall deſcribe them as intelligibly as poſſible, particularly the bark ſtove; by which it is hoped every curious perſon will be capable of directing his workmen in their ſtructure.

The dimenſion of this ſtove ſhould be proportioned to the number of plants intended to be preſerved, or the particular fancy of the owner; but their length ſhould not exceed forty feet, unleſs there are two fire-places; and, in that caſe, it will be proper to make a partition of glaſs in the middle, and to have two tan-pits, that there may be two different heats for plants from different countries, for the reaſons before given in the account of dry ſtoves; and were I to erect a range of ſtoves, they ſhould be all built in one, and only divided with glaſs partitions, at leaſt, the half way towards the front; which will be of great advantage to the plants, becauſe they may have the air in each diviſion ſhifted by ſliding the glaſſes of the partitions, or by opening the glaſs-door, which ſhould be made between each diviſion, for the more eaſy paſſage from one to the other.

This ſtove ſhould be raiſed above the level of the ground, in proportion to the drineſs of the place; for, if it be built on a moiſt ſituation, the whole ſhould be placed upon the top of the ground; ſo that the brick-work in the front muſt be raiſed three feet above the ſurface, which is the depth of the bark-bed, whereby none of the bark will be in danger of lying in water; but, if the ſoil be dry, the brick-work in front need not be more than one foot above-ground, and the pit may be ſunk two feet below the ſurface. Upon the top of this brick-work, in front, muſt be laid the plate of timber, into which the wood-work of the frame is to be mortiſed; and the upper timber in front muſt be placed four feet aſunder, or ſomewhat more, which is the proportion of the width of the glaſs-doors or ſaſhes: theſe ſhould be about ſix feet and an half, or ſeven feet long, and placed upright; but from the top of theſe ſhould be ſloping glaſſes, which ſhould reach within three feet of the back of the ſtove, where there ſhould be a ſtrong crown-piece of timber placed, in which there ſhould be a groove made for the glaſſes to ſlide into. The wall in the back-part of the ſtove ſhould be at leaſt thirteen inches thick; but eighteen inches is ſtill better; becauſe, the thicker the out-ſide wall is built, the more the heat of the flues will be kept in the houſe; and carried up, about nine feet above the ſurface of the bark-bed; and, from the top of this wall, there ſhould be a ſloping roof to the crown-piece where the glaſſes ſlide in. This crown-piece ſhould be about ſixteen feet high from the ſurface of the bark-bed or floor, which will give a ſufficient declivity to the ſloping glaſſes to carry off the wet, and be of a reaſonable height for containing many tall plants. The back-roof may be ſlated, covered with lead, or tiled, according to the fancy of the owner: for the manner of this outſide building is often very various, and differently built.

In the front of the houſe there ſhould be a walk, about eighteen or twenty inches wide, for the conveniency of walking; next to which the bark pit muſt be placed, which ſhould be in width proportionable to the breadth of the houſe: if the houſe is twelve feet wide, which is a due proportion, the pit may be ſeven feet wide; and behind the pit ſhould be a walk eighteen inches wide, to paſs in order to water the plants, &c. then there will be twenty-two inches left next the back-wall, to erect the flues, which muſt be all raiſed above the top of the bark-bed; theſe flues ought to be one foot wide in the clear, that they may not be too ſoon ſtopped with the ſoot; and the lower flue, into which the ſmoke firſt enters from the fire, ſhould be two feet deep in the clear; and this may be covered either with caſt iron plates, or broad tiles; over this the ſecond flue muſt be returned back again; which may be eighteen inches deep, and covered on the top as before; and ſo, in like manner, the flues may be returned over each other three or four times, that the heat may be ſpent before the ſmoke paſſes off. The thickneſs of the wall in front of theſe flues need not be more than four inches; but it muſt be well jointed with mortar, and plaiſtered withinſide to prevent the ſmoke from getting into the houſe; and the out-ſide ſhould be faced with mortar, and covered with a coarſe cloth, to keep the mortar from cracking, as is practiſed in ſetting up coppers. If this be carefully done, there will be no danger of the ſmoke entering the houſe, which cannot be too carefully avoided; for there is nothing more injurious to plants than ſmoke, which will cauſe them to drop their leaves; and, if it continue long in the houſe, will entirely deſtroy them.

The fire-place may be made either at one end, or in the middle, according as there is moſt conveniency; for, where-ever it is placed, it ſhould have a ſhed over it, and not be expoſed to the open air; for it will be impoſſible to make the fire burn equally, where the wind has full ingreſs to it; and it will be troubleſome to attend the fire in wet weather, where it is expoſed to the rain.

The contrivance of the furnace muſt be according to the fuel which is deſigned to burn; but, as turf is the beſt firing for ſtoves, where it can be had, becauſe it burns more moderately, and laſts longer, than any other

ſort of fuel, and ſo requires leſs attendance, I ſhall deſcribe a proper ſort of furnace for that purpoſe.

The whole of this furnace ſhould be erected within the houſe, which will be a great addition to the heat; and the front wall on the outſide of the fire place, next the ſhed, ſhould be three bricks thick, the better to prevent the heat from coming out that way. The door of the furnace, at which the fuel is put in, muſt be as ſmall as conveniently may be to admit of the fuel; and this door ſhould be placed near the upper part of the furnace, and made to ſhut as cloſe as poſſible; ſo that there may but little of the heat paſs off through it. This furnace ſhould be about twenty inches deep, and ſixteen inches ſquare at bottom; but may be ſloped off on every ſide, ſo as to be two feet ſquare at the top; and under this furnace ſhould be a place for the aſhes to fall into, which ſhould be about a foot deep, and as wide as the bottom of the furnace: this ſhould alſo have an iron door to ſhut as cloſe as poſſible; but juſt over the aſh-hole, above the bars which ſupport the fuel, ſhould be a ſquare hole about four inches wide, to let in air to make the fire burn: this muſt alſo have an iron frame, and a door to ſhut cloſe when the fire is perfectly lighted, which will make the fuel laſt the longer, and the heat will be more moderate.

The top of this furnace ſhould be nearly equal to the top of the bark-bed, that the loweſt flue may be above the fire; ſo that there may be a greater draught for the ſmoke; and the furnace ſhould be covered with a large iron plate, cloſely cemented to the brick work, to prevent the ſmoke from getting out; or it may be arched over with bricks; but you ſhould be very careful, whereever the fire is placed, that it be not too near the bark-bed; for the heat of the fire will, by its long continuance, dry the bark, ſo that it will loſe its virtue, and be in danger of taking fire; to prevent which, it will be the beſt method to continue an hollow between the brick-work of the fire and that of the pit, about eight inches wide; which will effectually prevent any damage ariſing from the heat of the fire; and there ſhould be no wood-work placed any where near the flues, or the fire-place, becauſe the continual heat of the ſtove may in time dry it ſo much, as to cauſe it to take fire; which ought to be very carefully guarded againſt.

The entrance into this ſtove ſhould be either from a green-houſe, the dry ſtove, or elſe through the ſhed where the fire is made, becauſe, in cold weather, the front-glaſſes muſt not be opened.

The other ſort of ſtove, which is commonly called the dry ſtove, as was before ſaid, may be either built with upright and ſloping glaſſes at the top, in the ſame manner, and after the ſame model of the bark ſtove; or elſe the front-glaſſes, which ſhould run from the floor to the cieling, may be laid ſloping, to an angle of forty-five degrees, the better to admit the rays of the ſun in ſpring and autumn: the latter method has been chiefly followed by moſt perſons who have built this ſort of ſtoves; but, were I to have the contrivance of a ſtove of this kind, I would have it built after the model of the bark ſtove, with upright glaſſes in front, and ſloping glaſſes over them, becauſe this will more eaſily admit the ſun at all the different ſeaſons; for, in ſummer, when the ſun is high, the top glaſſes will admit the rays to ſhine almoſt all over the houſe; and, in winter, when the ſun is low, the front glaſſes will admit its rays; whereas, when the glaſſes are laid to any declivity in one direction, the rays of the ſun will not fall directly thereon above a fortnight in autumn, and about the ſame time in ſpring; and, during the other parts of the year, they will fall obliquely thereon; and, in ſummer, when the ſun is high, the rays will not reach above five or ſix feet from the glaſſes.

Beſides, the plants placed towards the back-part of the houſe will not thrive in the ſummer-ſeaſon for want of air; whereas, when there are ſloping glaſſes at the top, which run within four feet of the back of the houſe; theſe, by being drawn down in hot weather, will let in perpendicular air to all the plants; and, of how much ſervice this is to all ſort of plants, every one who has had opportunity of obſerving the growth of plants in a ſtove, will eaſily judge: for, when plants are placed under cover of a cieling, they always turn themſelves towards the air and light, and thereby grow crooked; and if, in order to preſerve them ſtraight, they are turned every week, they will nevertheleſs grow weak, and look pale and ſickly, like a perſon ſhut up in a dungeon; for which reaſons, I am ſure, whoever has made trial of both ſorts of ſtoves, will readily join with me to recommend the model of the bark ſtove for every purpoſe. *Miller's Gard. Dict.*

STOVE, among confectioners, denotes a little cloſet, well encloſed on all ſides; wherein they dry their ſweetmeats, ranged on ſeveral rows of ſhelves, made of wire.

STRABISMUS, στραβισμὸς Squinting, in medicine and ſurgery, a diſtortion of the eyes, whereby their pupils are turned from, inſtead of being directed towards objects at which they look; ſometimes only one eye, but more frequently both are thus affected.

This diſorder is frequently cauſed in infants, from letting them conſtantly ſuck at one and the ſame breaſt; or from placing them in the cradle, ſo as that they always look the ſame way towards the light or window; by which repeated action, the muſcles on that ſide become too ſtrong to be ballanced by their oppoſite muſcles; and hence the eye is contorted, or looks obliquely at objects. But it may be alſo owing to convulſive and epileptic motions, to which the eyes of infants are extremely ſubject. And, laſtly, it may proceed, as well in adults as infants, from a ſpaſm, or rigor, or from a palſy in ſome of the muſcles of the eye; as alſo from a defect, or inſenſibility, of ſome part of the retina.

Squinting is a diſorder very difficult to be cured, eſpecially when in adults, and cauſed by ſome defect in the muſcles, or retina: but, in young infants, it may probably be cured, ſays St. Yves, by frequently placing them before a looking-glaſs, that their eyes may be directed towards the image of their own face. Thoſe more advanced in years may be aſſiſted by reading very ſmall writing or print; or by inſpecting very minute objects, provided they turn their eyes even, and bathe them at times with hungary-water. Others propoſe to cure this diſorder with a ſort of maſk, or eye-ſwath; but this method is ſeldom practicable, through the moroſeneſs of infants, and other impediments.

STRAIGHT, STREIGHT, or STRAIT, in hydrography, a narrow ſea, or gut ſhut up between lands on either ſide, and affording a paſſage out of one great ſea into another.

STRAIN, or SPRAIN, a violent extenſion of the ſinews or tendons of ſome muſcle.

STRANGURY, in medicine, a partial ſuppreſſion of urine; when it is total, it is called iſchuria.

Theſe caſes are either true or ſpurious; true, if the ſuppreſſion happens while the bladder is full; but ſpurious when, through ſome fault in the parts, there is no ſeparation made of the urine, ſo that the bladder remains empty.

Paralytic or convulſive motions in the ſphincter veſicæ may cauſe theſe diſorders. The neck of the bladder may be alſo too cloſely ſhut up by tumors, ſchirrhoſities, inflammations, cittoſities, caruncles, the ſtone, &c. The fœtus likewiſe by preſſing hard upon the neck of the bladder may give a riſe hereto; the inteſtinum rectum being filled with indurated fœces, or the hæmorrhoids being greatly ſwelled internally. This ſuppreſſion may likewiſe happen from the urine being long detained; which diſtending the bladder may preſs its neck againſt the adjacent parts ſo hard, as to hinder the excluſion of its contents. A ſuppreſſion of the urine alſo muſt neceſſarily enſue, when the ſerum of the blood is not duly ſeparated, as in dropſies; ſo likewiſe in luxations of the vertebræ of the back in fevers; or when the kidneys or ureters are obſtructed, &c. When this diſtemper proceeds from the ſtone, caruncles, tumors, &c. it is known by introducing the catheter. The other ſymptoms are eaſily diſcovered from the relaxation of the patient. If it proceed from inanition no tumor appears, there is a little pain, and the deſire of making water returns leſs frequently, nor is there any weight or preſſure perceivable in the abdomen; all which ſymptoms attend, when it proceeds from repletion.

An iſchuria is more dangerous than a ſtranguria, and, if it continues long, proves always mortal; eſpecially if it be from repletion, or when the ſpinal vertebræ are broke. The ſuppreſſion continuing and hiccup ſupervening is accounted a ſign of death.

As to the treatment, in order to obtund the acrimony of the blood, and take off the ſpaſtic motions, there is no medicine ſo uſeful as nitre, whether given alone, or mixed with ſome abſterſive ſalt, or with an abſorbent, mixed with a ſmall quantity of an acid to ſaturate it, and with a little cinnabar. A compound powder may be prepared of theſe ingredients, and a ſcruple of it given four times a day, will uſually ſoon take off the complaint.

The cooling emulſions, made with barley-water and almonds, and with the cold ſeeds, are alſo of great ſervice: and when there is farther occaſion for medicines, gum arabic, and pills of boiled turpentine, are found very good ones; and decoctions of liquorice roots in barley-water, with ſyrup of marſh-mallows, may be drank in large draughts. Many people are alſo fond of external remedies, and recommend onions, roaſted and buttered, to be applied to the pubes, and goat's ſuet to be rubbed warm about the navel.

A common ſtrangury is often carried off by mere diluters, ſuch as tea, barley-water, or any other watery liquor, drank in large quantities, till a ſweat comes on; and in the gentler caſes, where theſe alone are not quite effectual, there is no better addition to them than a little nitre.

Bleeding in time often prevents great miſchiefs from theſe diſorders; and in caſes of a dyſury, brought on by the taking cantharides, there is no remedy ſo powerful as warm milk alone, drank in large quantities. Mr. Boyle has alſo ſaid much in favour of Venice-ſoap on this occaſion.

STRAP, among ſurgeons, a ſtrong piece of leather, or the like, uſed for ſtretching limbs, in the ſetting broken or diſlocated bones.

STRAPS *of a Saddle*, are ſtrong leather thongs, nailed to the bows of a ſaddle, in order to make the girths, &c. faſt.

STRAPADO, or STRAPPADO, a kind of military puniſhment, wherein the criminal is hoiſted up by a rope, and let down; ſo that, by the weight of his body in the fall, his arms are diſlocated.

STRATA, in natural hiſtory, the ſeveral bodies or layers of different matters of which the body of the earth is compoſed.

The ſtrata include all the layers of earths, minerals, metals, ſtones, &c. lying under the upper tegument or ſtratum, the turf, or mould,

The time when theſe ſeveral ſtrata was laid was doubtleſs at the creation; unleſs with ſome great naturaliſts, as Steno, Dr. Woodward, &c. we ſuppoſe the globe of the earth to have been diſſolved by the flood.

At that time, ſays Mr. Derham, whenever it was when the terreſtrial globe was in a chaotic ſtate, and the earthy particles ſubſided, then theſe ſeveral beds were repoſited in that commodious order in which they are now found; and that, as is aſſerted, according to the laws of gravity, the lower ſtill heavier than the upper.

But Dr. Leigh, in his natural hiſtory of Lancaſhire, ſpeaking of the coal pits, denies the ſtrata to be according to the laws of gravitation; obſerving that the ſtrata there are firſt a bed of marle, then free-ſtone, next iron-ſtone, then coal, or channel mire, then ſome other ſtrata, then coal again. This determined Dr. Derham to make a nicer enquiry into the matter; accordingly, in 1712, he cauſed divers places to be bored, laying the ſeveral ſtrata by themſelves, and afterwards determined very carefully their ſpecific gravity. The reſult was that, in his yard, the ſtrata were gradually ſpecifically heavier and heavier, the lower and lower they went; but, in another place in his field, he could not perceive any difference in the ſpecific gravities.

Acquainting the Royal Society therewith, their operator, Mr. Haukſbee, was ordered to try the ſtrata of a coal pit, which he did to the depth of thirty ſtrata: the thickneſs and ſpecific gravity of each of which he gives us in a table in the Philoſophical Tranſactions, and from the whole makes this inference, that it evidently appears the gravities of ſeveral ſtrata are in no manner of order, but purely caſual, as if mixed by chance.

STRATAGEM, a military wile; or, a device in war for the ſurpriſing or deceiving the enemy.

The word is formed from the Greek στρατηγεω, to lead or command an army.

STRATEGUS, in Grecian antiquity, an annual officer among the Athenians, of which there were two choſen, to command the troops of the ſtate.

STRATIFICATION, in chemiſtry, the ranging any thing to be calcined in ſeveral layers or ſtrata one above another; which operation is denoted by the abbreviation S. S. S.

STRAWBERRY, *Fragaria*, in botany. See FRAGARIA.

The common ſtrawberry is frequent in the woods of England, and is thence tranſplanted into gardens. The beſt ſeaſon for this is in September, that the plants may be rooted before the froſts. They may alſo be tranſplanted in February; but then, if the ſpring ſhould prove dry, they will require a great deal of watering to keep them alive.

The proper ſoil for ſtrawberries is a light hazely loam, not over rich; the ground muſt be well dug, and very carefully cleared of all noxious weeds; and, when it is levelled even, it ſhould be marked out into beds about three feet and a half wide, leaving a path-way between each bed of two feet broad. In each of theſe beds ſhould be planted four rows of plants, ſo that they may ſtand about a foot diſtance from each other in the rows, and they ſhould be planted at about eight inches plant from plant in each. This is the proper diſtance for the wood ſtrawberry, which is of the leaſt growth of any; but the ſcarlet ſtrawberry muſt be planted at a foot diſtance every way, and the hautboy ſixteen inches; and, finally, the large Chili ſtrawberry, which is the largeſt grower of all, muſt be ſet at twenty-two inches diſtance plant from plant.

In the ſpring, when the ſtrawberries begin to flower, if the ſeaſon is dry, they muſt be very plentifully watered, and they muſt be kept very carefully cleared from weeds. At Michaelmas the beds ſhould be dreſſed, the weeds all very carefully taken up, all the ſtrings or runners muſt be taken from the roots, and the weak plants, which ſtand too cloſe, muſt be pulled up; throwing a little fine earth, at the ſame time, over the plants, alſo greatly ſtrengthens their roots. Theſe beds, however well managed, will not continue good above three years; and, the beds of the firſt year bearing but few fruit, it is neceſſary to new-plant ſome freſh ground every third year, and deſtroy the old beds; but the new ones muſt be firſt of one year's growth.

Different palates prefer different ſpecies of ſtrawberries, but the white-fruited one is, of all others, the beſt flavoured; though it is but a very bad bearer. The great Chili ſtrawberry is cultivated in the fields in that country; it is a much ſtronger and larger plant than any of our kinds, and its fruit is as large as a walnut, but not ſo well taſted as our own ſtrawberries. Mr. Frezier brought them ſome years ago to Paris, and, ſince that, they have been ſpread over the ſeveral parts of Europe. They grow beſt in a loamy ſoil under the ſhade of trees. *Miller's Gard. Dict.*

STRENGTH, *vis*, in phyſiology, the ſame with force.

The ſtrengths of different animals of the ſame ſpecies or of the ſame animal, at different times, are demonſtrated to be in a triplicate proportion of the quantities of the maſs of their blood; the whole ſtrength of an animal is the force of all the muſcles taken together; therefore, whatever increaſes ſtrength, increaſes the force of all the muſcles, and of thoſe ſerving digeſtion as well as others.

STRENGTHENERS, in pharmacy, medicines that add to the bulk and firmneſs of the ſolids; and ſuch are all abſorbent, agglutinant, and aſtringent medicines.

STRIÆ, in the ancient architecture, the liſts, fillets, or rays which ſeparate the ſtriges or flutings of columns.

Among

Among naturaliſts, the term ſtriæ denotes the ſmall channels and ridges in ſcollop-ſhells, &c.

STRICTOR, in anatomy, the ſame with conſtrictor and ſphincter.

STRIKE, a meaſure of capacity, containing four buſhels.

STROPHE, in the Greek and Latin poetry, a ſtanza or certain number of verſes including a perfect ſenſe; ſucceeded by another conſiſting of the ſame number and meaſure of verſes, and in the ſame diſpoſition and rhythmus, called antiſtrophe.

The work is Greek, στροφη, formed from στρεφω, to turn; becauſe at the end of the ſtrophe the ſame meaſures returned again; or rather, as the term related principally to the muſic or dancing, becauſe at firſt coming in the chorus, or the dancers, turned to the left, and, that meaſure ended, they turned back again to the right.

STRUMÆ, in medicine, tumors ariſing moſt uſually on the neck and throat; called alſo ſcrophulæ, and popularly the evil or king's evil.

STUC, or STUCCO, in building, a compoſition of white marble, pulverized and mixed with plaſter of lime, the whole ſifted and wrought up with water; to be uſed like common plaſter. This is what Pliny means by marmoratum opus, and albarium opus.

STUFF, in commerce, a general name for all kinds of fabrics of gold, ſilver, ſilk, wool, hair, cotton, or thread, manufactured on the loom; of which number are velvets, brocades, mohair, ſattins, taffeties, cloth, ſerges, &c.

STUM, in the wine-trade, denotes the unfermented juice of the grape, after it has been ſeveral times racked off, and ſeparated from its ſediment. The caſks are for this purpoſe, well matched, or fumigated with brimſtone every time, to prevent the liquor from fermenting, as it would otherwiſe readily do, and become wine.

It is this fume of the ſulphur from the match, that prevents, in this caſe, all tendency to fermentation, and continues the natural juice of the grape in a ſweet ſtate, fit to be readily mixed with wines inſtead of ſugar; for which purpoſe it is very much uſed in Holland, and ſome other countries; as alſo for giving a new fret, or briſkneſs to decayed wines: ſo that very large quantities of this ſtum are annually imported to all parts, along with the foreign wines. And after the ſame manner a ſtum is prepared in England, from the juice of apples, which ſerves the ordinary purpoſes of the wine-cooper. In the preſerving this liquor in this ſtate, we ſee the vaſt uſe of brimſtone, for it could never be done otherwiſe than by the matching of the caſks.

Dr. Shaw gives the following method of preparing an artificial ſtum, nothing inferior to the natural; and as fit for the refermenting, fretting, improving, or making of wines, vinegars, and ſpirits. Take three pounds of fine lump-ſugar, or ſuch as has been well refined from its treacle; melt it in three quarts of water, and add, in the boiling, of Rheniſh tartar, finely powdered, half an ounce; this diſſolves with a remarkable ebullition, and gives a grateful acidity to the liquor: take the veſſel from the fire, and ſuffer it to cool, and you have an artificial muſt, which in all reſpects reſembles the natural taſte and ſweet juice of a white flavourleſs grape, when well purified, and racked off from its ſediment, in order to make ſtum. If this artificial muſt be ſtummed, that is, well fumigated, with burning brimſtone, it becomes a perfect ſtum, and may be made of any flavour, at the diſcretion of the artiſt.

STUPEFIERS, in medicine, the ſame with narcotics and opiates.

STUPOR, a numbneſs in any part of the body, whether occaſioned by ligatures obſtructing the blood's motion, by the palſy, or the like.

STURGEON, *Sturio*, a well known large and fine-taſted fiſh, caught in many places, and ſometimes in the river Thames, being one of thoſe fiſhes called anadromi by authors, which ſpend a part of their time in the ſea, and a part in rivers.

It never goes into the ſea to any great diſtance, and never is caught there of any very great ſize. The ſea ſerves for its production, but it is only in large rivers that it grows to its uſual ſize.

STYE, or STITHE, a diſorder of the eye-lids; being a ſmall encyſted tumor, about the bigneſs of a barley-corn.

The ſtye frequently occaſions much pain and uneaſineſs, and muſt be treated with great caution, on account of the tenderneſs of the eye. Some recommend cataplaſms, and the like applications; but the eye is often hurt by thoſe; and it is obſerved beſides, that theſe tubercles ſeldom give way to topical applications of any kind.

When they are ſmall, Heiſter thinks it beſt to let them take their own courſe: but if ſo large as to occaſion deformity, or danger of hurting the ſight, the way to extirpate them, is to make a longitudinal inciſion on the part, and carefully take them out whole; or, if it cannot be thus got out clean, it muſt be cut out, as far as may be done, with ſciſſars, and dreſſed with Ægyptian ointment, and a little red precipitate, or touched at times with the common cauſtic, till eaten thoroughly away, and then the wound dreſſed and healed in the common manner.

This is the method by which the flat and broad-bottomed tumours of this kind are to be extirpated; and in this, great care muſt be taken that none of the ſharp applications touch the eye, as they might injure the ſight. It is common, however, with theſe tumours to hang by a ſort of ſmall root, and then they are much more eaſily managed, there being no more neceſſary than the cutting them cloſe off, with a pair of ſciſſars, or the tying them firmly round with a piece of ſilk or horſe-hair. They are ſometimes, if taken in time, diſperſed by rubbing them with faſting ſpittle, or by applying the pulp of a roaſted apple mixed with ſome ſaffron and camphor.

STYGIAN LIQUORS, an appellation given to cauſtic and corroſive waters, and particularly to aqua regia.

STYLE, a word of various ſignifications, originally deduced from στυλος, a kind of bodkin, wherewith the antients wrote on plates of lead, or on wax, &c. and which is ſtill uſed to write on ivory-leaves, and paper prepared for that purpoſe, &c.

STYLE, in dialling, denotes the gnomon or cock of a dial, raiſed on the plane thereof, to project a ſhadow.

STYLE, in matters of language, is the manner of expreſſing ourſelves, or of cloathing our thoughts in words.

The matter ought to direct us in the choice of the ſtyle. Noble expreſſions render the ſtyle loſty, and repreſent things great and noble; but, if the ſubject be low and mean, ſonorous words and pompous expreſſion is bombaſt, and diſcovers want of judgment in the writer. Figures and tropes paint the motions of the heart, but to make them juſt, and truly ornamental, the paſſion ought to be reaſonable. There is nothing more ridiculous than to be tranſported without cauſe, to put one's ſelf in a great heat for what ought to be argued coolly: whence it is plain, that the matter regulates the ſtyle. When the ſubject or matter is great, the ſtyle ought to be ſprightly, full of motion, and enriched with figures and tropes; if our ſubject contain nothing extraordinary, and we can conſider it without emotion, the ſtyle muſt be plain.

The ſubject of diſcourſe being extremely various in nature, it follows, there muſt be as great a variety in the ſtyle: but the maſters of this art have reduced them all to three kinds, which they call the ſublime, the low, and the intermediate.

Let the ſubject of which we deſign a loſty idea be never ſo noble, its nobleneſs will never be ſeen, unleſs we have ſkill enough to preſent the beſt of its faces to the view. The beſt of things have their imperfections, the leaſt of which, diſcovered, may leſſen our eſteem, if not extinguiſh it quite: we muſt therefore take care not to ſay any thing in one place, which may contradict what we have ſaid in another: we ought to pick out all that is moſt great and noble in our ſubject, and put that in its beſt light, and then our expreſſion muſt be noble and ſublime, capable of raiſing loſty ideas: and it is our duty

duty to obſerve a certain uniformity in our ſtyle; though all we ſay have not an equal magnificence, ſo far, at leaſt, as to make all the parts of a piece bear a correſpondence with the whole.

The danger here is, leſt we fall into a puffy ſtyle, which ſome call inflation, or ſwelled; for, if we ſtretch things beyond their nature, and hunt only after great and ſounding words, we ſeldom mind their agreeableneſs to the nature of the ſubject. And this has been the fault of many of our modern tragic writers, who yet with the vulgar have gained applauſe, and ſettled a reputation.

We come next to the plain or low ſtyle; and this ſimple and plain character of writing is not without its difficulties; not in the choice of ſubjects, thoſe being always ordinary and common; but becauſe there is wanting in this ſtyle that pomp and magnificence which often hide the faults of the writer, at leaſt, from the general reader, or hearer. But on common and ordinary ſubjects there is little room for figures and tropes, ſo we muſt make choice of words that are proper and obvious. When we call the ſtyle ſimple and plain, we intend not meanneſs of expreſſion; that is never good, and ſhould always be avoided; for, though the matter or ſubject of this ſtyle have nothing of elevation, yet ought not the language to be vile and contemptible: mob-expreſſions, and vulgariſms, are to be avoided, and yet all muſt be clean and natural.

The intermediate, or middle ſtyle, conſiſts of a participation of the ſublime, on one ſide, and of ſimplicity of the plain, on the other. Virgil furniſhes us with examples of all the three; of the ſublime in his Æneids; the plain, in his Paſtorals, and the mean, or middle, in his Georgics.

Though the ſtyle of an orator, or one that ſpeaks in public, and of an hiſtorian and poet, are different, yet there are ſome differences in the ſtyles of the ſame character; for ſome are ſoft and eaſy, others more ſtrong; ſome gay, others more ſevere. Let us reflect on the differences, and how they are diſtinguiſhed.

The firſt quality is eaſineſs, and that is when things are delivered with that clearneſs and perſpicuity, that the mind, without any trouble, conceives them. To give this eaſineſs to a ſtyle, we muſt leave nothing to the hearer's or reader's deciſion; we muſt deliver things in their neceſſary extent, with clearneſs, that they may be eaſily comprehended; and here care muſt be taken of the fluency, and to avoid all roughneſs of cadence.

The ſecond quality is ſtrength, and it is directly oppoſite to the firſt; it ſtrikes the mind boldly, and forces attention. To render a ſtyle ſtrong, we muſt uſe ſhort and nervous expreſſions, of great and comprehenſive meaning, and ſuch as excite many ideas.

The third quality renders a ſtyle pleaſant and florid, and depends, in part, on the firſt; for the mind is not pleaſed with too ſtrong an intention. Tropes and figures are the flowers of ſtyle; the firſt give a ſenſible conception to the moſt abſtruſe thoughts; figures awaken our attention, and warm and animate the hearer, or reader, by giving him pleaſure. Motion is the principle of life and pleaſure; but coldneſs mortifies every thing.

The laſt quality is ſevere: it retrenches every thing that is not abſolutely neceſſary; it allows nothing to pleaſure, admitting no ornaments or decorations. In ſhort, we are to endeavour that our ſtyle have ſuch qualities, as are proper to the ſubject of which we diſcourſe.

STYLE, in muſic, denotes a peculiar manner of ſinging, playing, or compoſing; being properly the manner that each perſon has of playing, ſinging, or teaching; which is very different both in reſpect of different geniuſes, of countries, nations, and of the different matters, places, times, ſubjects, paſſions, expreſſions, &c.

Old STYLE, in chronology, is a method of computing time introduced by Julius Cæſar, and which was followed in England, till the late reformation of the calendar.

New STYLE, is the manner of computing time introduced by pope Gregory, when he reformed the Julian year; this is now followed in moſt countries of Europe.

STYLET, or STILETTO, a ſmall dangerous kind of poniard, which may be concealed in the hand, chiefly uſed in treacherous aſſaſſinations. The blade is uſually triangular, and ſo ſlender that the wound it makes is almoſt imperceptible. The ſtylet is prohibited in all well-diſciplined ſtates.

STYLOGLOSSUS, in anatomy, a muſcle ariſing from the apex of the ſtyloide proceſs; and, deſcending obliquely to the ſide and root of the tongue, moves it ſideways, backwards and forwards.

STYLOHYOIDÆUS, in anatomy, a pair of muſcles ariſing from the ſtyloide proceſs, and terminating in the horn and the baſe: this is often perforated by the digaſtric muſcle of the jaw. Theſe muſcles draw laterally upwards.

STYLOIDES, in anatomy, an apophyſis of the os petroſum, thus called from its reſembling a ſtyle or ſtylet.

STYLOPHARYNGÆUS, in anatomy, a pair of muſcles, ariſing round and fleſhy, from the proceſſus ſtyloides; and which in its oblique deſcent becomes thicker, and is afterwards expanded on the back parts of the fauces. It ſerves to draw up and dilate the pharynx.

STYPTIC, στυπτικον, in pharmacy, medicines which by their aſtringent qualities ſtop hæmorrhages.

When a conſiderable hæmorrhage is ſtopt by abſorbents or ſtyptics, it is always produced by means of a clot of blood, ſecured by compreſſion, ſo that the orifice of the veſſel is ſtopt. This clot generally conſiſts of two parts, the one without, and the other within, the veſſel: that without is formed by the laſt flowing blood, which, in coagulating, incorporates itſelf with the lint, moſs, or powders, uſed for ſtopping the blood: the other part of the clot within the veſſel, is only that portion of the blood which was ready to be diſcharged when the veſſel was ſtopped. Theſe two parts are often but one continued clot. That without the veſſel performs the office of a covering, whilſt that within ſerves as a kind of ſtopper. Alcohol, or pure ſpirit of wine, is the moſt uſual, and perhaps the beſt, ſtyptic; and is the baſis of moſt of the celebrated arcana for ſtopping hæmorrhages. Boerhaave ſays it becomes an immediate ſtyptic, as it prevents putrefaction, and occaſions a thin but very ſolid eſchar. For if pledgets be dipped in pure alcohol, made hot, and applied to a bleeding wound, if it be cloſely compreſſed upon the part, and covered with a piece of bladder lightly beſmeared with oil, and kept on with a proper bandage, the hæmorrhage preſently ceaſes, and the whole dreſſing may continue unremoved for three days, in which time the veſſels are uſually cloſed, and ſtrongly contracted and conſolidated, by means of the alcohol.

The ſtyptic powder of Helvetius is a medicine ſaid to be ſerviceable in uterine hæmorrhages, either to correct the too frequent return of the menſes, or their too great abundance; alſo to ſtop the flooding to which women with child are ſubject, and to moderate the flow of the lochia. It is alſo found to have very ſurprizing good effects in the fluor albus. It is a compoſition of alum and dragon's blood: and in the Edinburgh diſpenſatory, two parts of alum are directed to be made into powder with one of the dragon's-blood: others uſe equal parts of both. Heiſter recommends this powder or alum alone, with a decoction of linſeed.

Eaton's ſtyptic is famous for curing freſh wounds in a very ſmall time, and immediately ſtopping their bleeding: but Dr. Sprengel is ſaid to prove, beyond all poſſibility of doubt, that this is in effect no other than the ſtyptic of Helvetius.

The female agaric has been of late greatly celebrated as a ſtyptic, and is ſaid to reſtrain not only the venal but arterial hæmorrhages, without the uſe of ligatures.

SUB, a Latin prepoſition, ſignifying *under*, or *below*, frequently uſed in compoſition in our language: thus, 1. Sub-brigadier is an officer in the cavalry who commands under the brigadier, aſſiſting him in the diſcharge of his office. 2. Sub-chantor, an officer in the choir, who officiates in the abſence of the chantor. 3. Sub-deacon, an ancient officer in the church that was

made by the delivery of an empty platter and cup by the biſhop; and of a pitcher, baſon, and towel by the arch-deacon. His office was to wait on the deacon with the linnen whereon the body, &c. was conſecrated, and to receive and carry away the plate with the offerings at the ſacraments, and the cup with the wine in it, &c. 4. Sub-dean, a dignity in ſome chapters beneath the dean. 5. Sub-marſhal, an officer in the Marſhalſea that is deputy to the chief-marſhal of the king's houſe, who is commonly called knight-marſhal, and has the cuſtody of the priſoners there. 6. Sub-prior, a clauſtral officer who aſſiſts the prior, &c.

SUBALTERN, a ſubordinate officer, or one who diſcharges his poſt under the command and ſubject to the direction of another: ſuch are lieutenants, ſub-lieutenants, cornets and enſigns, who ſerve under the captain; but cuſtom has now appropriated the term to thoſe of much lower ranks, as ſerjeants, and the like. We alſo ſay ſubaltern-courts, juriſdictions, &c. Such are thoſe of inferior lords, with regard to the lord paramount; hundred courts, with regard to county-courts, &c.

SUBCLAVIAN, *Subclavius*, in anatomy, is applied to any thing under the arm-pit or ſhoulder, whether artery, nerve, vein, or muſcle.

Subclavius more particularly denotes a ſmall oblong muſcle lying between the clavicle and firſt rib. It is fixed by one end in all the middle lower portion of the clavicle, at the diſtance of about an inch from each extremity, and by the other in the cartilage, and a ſmall part of the bone of the firſt rib.

SUBCONTRARY POSITION, in geometry, is when two ſimilar triangles are ſo placed, as to have one common angle at the vertex, and yet their baſes not parallel.

SUBCOSTAL MUSCLES, *Subcoſtales*, in anatomy. Theſe muſcles are fleſhy planes of different breadths, and very thin, ſituated more or leſs obliquely on the inſide of the ribs, near their bony angles, and running in the ſame direction with the external intercoſtals. They are fixed by their extremities in the ribs, the inferior extremity being always at a greater diſtance from the vertebræ than the ſuperior, and ſeveral ribs lying between the two inſertions. Theſe muſcles are more ſenſible in the lower ribs than in the upper, and they adhere cloſely to the ribs that lie between their inſertions.

SUBCUTANEOUS, in anatomy, a thin membranous muſcle running under the ſkin, called alſo quadratus genæ, and platyſma myoides. It ariſes with a pretty broad origin from the hind part of the neck, and from the pectoral muſcle below the clavicle. It adheres firmly to the panniculus carnoſus, from which it is not ſeparated without difficulty, and therefore was not anciently diſtinguiſhed from it; and is inſerted obliquely on each ſide into the lower jaw-bone near the ſkin, lips, and ſometimes the bottom of the noſe, all which parts it draws downwards and awry.

A convulſion herein is called a ſpaſmus cynicus; in ſome perſons it reaches to the ears, and in others not; which is the reaſon ſome folks have a faculty of moving their ears, which others want.

SUBDUPLE *Ratio*, is when any number or quantity is contained in another twice—Thus, three is ſaid to be ſubduple of ſix, and ſix is duple of three.

SUBDUPLICATE RATIO of any two quantities is the ratio of their ſquare roots.

SUBJECT, *Subditus*, a perſon under the rule and dominion of a ſovereign prince or ſtate.

SUBJECT, *Subjectum*, is alſo uſed for the matter of an art or ſcience, or that which it conſiders, or wherein it is employed. Thus the human body is the ſubject of medicine.

SUBJUNCTIVE, in grammar, the fourth mood or manner of conjugating verbs; thus called becauſe uſually joined to ſome other verb, or, at leaſt, to ſome other particle, as, if "I loved, though this were true, &c."

The Greek is almoſt the only language that properly has any ſubjunctive mood; though the French, Spaniſh, and Italian, have ſome ſhew thereof. In all other languages the ſame inflections ſerve for the optative and ſubjunctive moods; for which reaſon the ſubjunctive mood might be retrenched from the Latin, and thoſe other grammars; it not being the different ways of ſignifying, which may be very much multiplied, but the different inflexions that conſtitute the different moods.

SUBLIMATE BODIES, a term uſed by ſome of our chemical writers to expreſs ſuch ſubſtances as are capable of ſublimation in a dry form.

SUBLIMATE, a chemical preparation, the baſis whereof is mercury or quickſilver. There are two kinds of ſublimate; corroſive ſublimate and ſweet ſublimate, or mercurius dulcis ſublimatus.

SUBLIMATION, the condenſing and collecting in a ſolid form by means of veſſels aptly conſtructed, the fumes of bodies raiſed from them, by the application of a proper heat. Sublimation is in all reſpects the ſame with diſtillation, except that in the firſt the produce is ſolid, but in the latter fluid. The only variation therefore neceſſary in the operation is the accommodating the recipient part of the apparatus to this difference, which admits, in moſt caſes, that one veſſel may perform the office both of condenſer and receiver, as the matter cannot, like fluids, flow to another part, but muſt remain where it firſt ſettles, except in ſome inſtances where the matter is extremely volatile, or where a fluid riſing with it renders a depending receiver neceſſary.

The veſſels proper, in reſpect of the different ſubjects of this operation, vary in their ſtructure and the ſubſtance of which they are made, as well on account of the degree of heat requiſite to be employed, as the nature of the matter to be ſublimed, ſince corroſions of them are here, and indeed in all other caſes, to be carefully avoided. In ſublimations of mercury, whether combined with acids or ſulphur, of ſal ammoniacum and of ſulphur alone, a ſingle veſſel may anſwer all the purpoſes, as their neceſſity of a great heat to keep them in the condition of fumes renders the upper part of the glaſs capable of detaining them when they are raiſed thereto; but it is proper, in theſe inſtances, that a glaſs in ſand, or earthen ware, ſhould be uſed. A glaſs body in a ſtrong ſand-heat may very well ſerve for all theſe; but ſublimate of mercury is frequently ſublimated in a bolt-head or matraſs; and the factitious cinnabar, by thoſe who make large quantities, in an earthen veſſel made in the ſhape of an egg. In the ſublimation of volatile ſalts, ſalt of amber, and flowers of benjamin, a container and condenſer are ſeparately neceſſary, and they may, in all theſe caſes, be extremely well ſupplied by a retort and receiver; though bodies with alembic heads, and receivers of glaſs fitted to them, have been generally recommended in ſeveral of them; but the luting two junctures, the difficulty of fitting them in each other, with ſeveral other reaſons, make retorts far more convenient. A retort and receiver are likewiſe proper in the caſe of cinnabar of antimony; for, though the cinnabar might be eaſily reſtrained in one glaſs, the butter of antimony makes a receiver neceſſary.

In ſublimation of factitious cinnabar, mercury ſublimate and ſal ammoniacum, &c. is ſufficient to cover the aperture or neck of the veſſels with a piece of tile, and, in the ſublimation of cinnabar of antimony and flowers of benjamin in retorts, it is neceſſary to lute on the receiver; but, in the ſublimation of volatile ſalts, it is requiſite to lute the veſſels as ſecurely as poſſible, leaving only a ſmall vent, till they attain the greateſt heat they are to ſuffer during the operation.

The requiſite degree of heat in ſublimation varies in almoſt every different ſubject of the operation. The limits are from the greateſt degree that can be given in ſand, to a degree ſomething leſs than that which will make water boil.

Hoffman obſerves, that only thoſe things are ſublimable which contain a dry exhaleable matter in their original conſtruction; and among theſe is found a great variety, which require various methods and means to execute that effect.

Among the minerals, ſulphur, antimony, and orpiment, are named as the principal ſublimable bodies: theſe are of a very lax compage or ſtructure, and eaſily raiſed by fire in ſmall particles, which concrete again on being ſtopt from flying off by the cover of the veſſel; while, on the contrary, iron, ſilver, and the other metals, being of a cloſer ſtructure, remain fixed in the

greateſt heat, and never aſcend without being mixed with ſome volatile ſubſtance that is of itſelf capable of riſing and taking up ſome of them with it.

Thus copper and iron will be raiſed in ſublimation by means of ſal ammoniac mixed with them; and even gold itſelf is ſaid to be ſubject to the ſame law; Mr. Boyle aſſuring us that he had a ſecret method of preparing a certain ſaline ſubſtance, by means of a very ſmall admixture of which, gold would be made to riſe in ſublimation, and form fine purple cryſtals.

The admixtures which make bodies ſublimable that are not ſo in themſelves, are to be of various kinds, according to the nature of the body to be ſublimed. Among theſe ſome act by rendering the body more eaſily fuſible, and diſuniting thoſe particles more readily which the fire is expected to carry up: others act again by preventing the coheſions of the particles of the ſubſtance to be ſublimed, which heat would otherwiſe occaſion: and, finally, others, by entering the body of the fixed ſubſtance they are mixed with, and giving wings, as it were, to its ſubtile particles, ſo that they may aſcend with its eaſily ſublimable matter, and join with it in the formation of one mixed ſubſtance in the top of the veſſel, by partaking of the nature of both. Others act potentially in the ſame way, but by different means, themſelves not being capable of ſublimation, but acting on the ſubſtance to be ſublimed, by enervating, weakening, or abſorbing thoſe ſubſtances, or parts, of the mixed body, which would otherwiſe have prevented the aſcent of the reſt; and, finally, ſome act as diſſolvents only, and by that means render things eaſy of ſublimation, which would have been very difficultly ſo, while their parts were in a more ſtrict continuity.

SUBLIME, in diſcourſe, is defined by Boileau, to be ſomething extraordinary and ſurpriſing, which ſtrikes the ſoul, and makes a ſentiment or compoſition raviſh and tranſport.

From this definition it appears, that the ſublime is a very different thing from what the orators call the ſublime ſtyle. The ſublime ſtyle neceſſarily requires big and magnificent words; but the ſublime may be found in a ſingle thought, a ſingle figure, a ſingle turn of words. A thing may be in the ſublime ſtyle and yet not be ſublime; that is, it may have nothing extraordinary and ſurprizing.

Longinus makes five ſources of the ſublime: the firſt, a certain elevation of the mind, which makes us think happily: the ſecond is the pathetic, or that natural vehemence and enthuſiaſm which ſtrikes and moves us; theſe two are wholly owing to nature, and muſt be born with us; whereas the reſt depend partly on art: the third is the turning of figures in a certain manner, both thoſe of thoughts and of ſpeech: the fourth, nobleneſs of expreſſion; which conſiſts of two parts, the choice of words, and the elegant figurative diction: the fifth, which includes all the reſt, is the compoſition and arrangement of the words in all their magnificence and dignity.

SUBLINGUAL GLANDS, in anatomy, two glands under the tongue, placed one on each ſide thereof. Theſe, called alſo hypoglottides, filtrate a ſerous humour of the nature of ſaliva, which they diſcharge by little ducts near the gums into the mouth.

SUBMULTIPLE, in geometry, &c. A ſubmultiple number, or quantity, is that which is contained a certain number of times in another, and which, therefore, repeated a certain number of times, becomes exactly equal thereto; thus 3 is a ſubmultiple of 21; in which ſenſe ſubmultiple coincides with an aliquot part.

SUBMULTIPLE RATIO is that between the quantity contained and the quantity containing: thus the ratio of 3 to 21 is ſubmultiple. In both caſes ſubmultiple is the reverſe of multiple, 21, e. g. being a multiple of 3, and the ratio of 21 to 3 a multiple ratio. See the article RATIO.

SUBNORMAL, in geometry, a line which determines the point in the axis of a curve, where a normal, or perpendicular, raiſed from the point of contact of a tangent to the curve, cuts the axis. Or the ſubnormal is a line which determines the point wherein the axis is cut by a line falling perpendicularly on the tangent in the point of the contact: thus T M plate CXXIII. *fig.* 2. being a tangent to a curve in M, and M R a normal or perpendicular to the tangent, the line P R intercepted between the ſemiordinate P M, and the normal M R, is called the ſubnormal. Hence 1 in a parabola, as A M, &c. the ſubnormal P R is to the ſemi-ordinate P M, as P M is to P T, and M R to T M. 2. In the parabola the ſubnormal P R is ſubduple the parameter, and, conſequently, an invariable quantity.

SUBORDINATION, a relative term, expreſſing the degree of inferiority between one thing and another.

SUBORDINATION, a ſecret or underhand preparing, inſtructing, or bringing in a falſe witneſs, or corrupting or alluring a perſon to do ſuch a falſe act.

SUBPŒNA, a writ, whereby any perſon, under the degree of peerage, is called to appear in Chancery, in caſes where the common law has made no proviſion.

The name is taken from the words in the writ, which charge the party ſummoned to appear at the day and place aſſigned, *ſub pœna centum librarum*, on the penalty of an hundred pounds.

SUBROGATION, or SURROGATION, in the civil law, the act of ſubſtituting in the place, and intitling him to the rights, of another.

SUBSCAPULARIS, in anatomy, a muſcle ariſing from the baſis and ſide of the ſcapula, and ſpreading itſelf under the whole convex, or under ſide of it; it is inſerted by a ſemi-circular tendon into the os humeri, and draws it down to the ſide of the trunk.

SUBSCRIPTION in general ſignifies the ſignature put at the bottom of a letter, writing, or inſtrument.

In commerce, it is uſed for the ſhare or intereſt which particular perſons take in a public ſtock or trading company, by writing their names, and the ſhares they require in the books or regiſter thereof.

Subſcription, in the commerce of books, ſignifies an engagement to take a certain number of copies of a book going to be printed; and a reciprocal obligation of the bookſeller or publiſher to deliver the ſaid copies on certain terms.

SUBSEQUENT, ſomething that comes after another, particularly with regard to the order of time.

SUBSIDY, in law, ſignifies an aid or tax granted to the king, by parliament, for the neceſſary occaſions of the kingdom; and is to be levied on every ſubject of ability, according to the rate or value of his lands or goods: but this word, in ſome of our ſtatutes, is confounded with that of cuſtoms.

SUBSISTENCE, in the military art, is the money paid to the ſoldiers weekly, not amounting to their full pay; becauſe their cloaths, accoutrements, tents, bread, &c. are to be paid. It is likewiſe the money paid to officers upon account, till their accounts be made up, which is generally once a year, and then they are paid their arrears.

SUBSTANCE, *Subſtantia*, ſomething that we conceive to ſubſiſt of itſelf, independently of any created being, or any particular mode or accident.

Thus, a piece of wax is a ſubſtance, becauſe we can conceive it as ſubſiſting of itſelf, and of its own nature, without any dependance on any other created nature, or without any particular mode, form, colour, &c.

Spinoſa maintains, that there is but one only ſubſtance in nature, whereof all created things are ſo many different modifications; and thus he makes the ſoul of the ſame ſubſtance with the body. The whole univerſe, according to him, is but one ſubſtance; which ſubſtance he holds endowed with an infinity of attributes, in the number of which are thinking and extenſion. All bodies are modifications of this ſubſtance, conſidered as extended; and all ſpirits modifications of the ſame ſubſtance, conſidered as thinking.

Mr. Locke's philoſophy of ſubſtances is more orthodox. Our ideas of ſubſtance, that great author obſerves, are only ſuch combinations of ſimple ideas, as are taken to repreſent diſtinct things, ſubſiſting by themſelves; in which the confuſed idea of ſubſtance is always the chief. Thus the combination of the ideas of a certain figure, with the powers of motion, thought, and reaſoning, joined to ſubſtance, make the ordinary idea of man; and thus the mind obſerving ſeveral ſimple ideas to go con-

conſtantly together, which being preſumed to belong to one thing, or to be united in one ſubject, are called by one name; which we are apt, afterwards, to talk of and conſider as one ſimple idea.

We imagine the ſimple ideas do not ſubſiſt by themſelves; but ſuppoſe ſome ſubſtratum, wherein we ſubſiſt, which we call ſubſtance.

The idea of pure ſubſtance is nothing but the ſuppoſed, yet unknown ſupport of thoſe qualities which are capable of producing ſimple ideas in us.

The ideas of particular ſubſtances are compoſed out of this obſcure and general idea of ſubſtance, together with ſuch combinations of ſimple ideas, as are obſerved to exiſt together, and ſuppoſed to flow from the internal conſtitution, and unknown eſſence of that ſubſtance.

Thus we come by the ideas of man, horſe, gold, &c. Thus the ſenſible qualities of iron, or a diamond, make the complex idea of thoſe ſubſtances, which a ſmith, or a jeweller, commonly knows better than a philoſopher.

The ſame happens concerning the operations of the mind, viz. thinking, reaſoning, &c. which we concluding not to ſubſiſt by themſelves, nor apprehending how they can belong to body, or be produced by it, we think them the actions of ſome other ſubſtance, which we call ſpirit; of whoſe ſubſtance or nature we have as clear a notion, as of that of body; the one being but the ſuppoſed ſubſtratum of the ſimple ideas we have from without; as the other of thoſe operations, which we experiment in ourſelves within: ſo that the idea of corporeal ſubſtance in matter is as remote from our conceptions, as that of ſpiritual ſubſtance.

Hence we may conclude, that he has the perfect idea of any particular ſubſtance, who has collected moſt of thoſe ſimple ideas which exiſt in it; among which we are to reckon its active powers and paſſive capacities, though not ſtrictly ſimple ideas.

Subſtances are generally diſtinguiſhed by ſecondary qualities; for our ſenſes fail us in the diſcovery of primary ones, as the bulk, figure, texture, &c. of the minute parts of bodies, on which their real conſtitutions and differences depend.—And ſecondary qualities are nothing but powers, with relation to our ſenſes.

The ideas that make our complex ones of corporeal ſubſtances, are of three ſorts: firſt, the ideas of primary qualities of things, which are diſcovered by our ſenſes; ſuch as bulk, figure, motion, &c. Secondly, the ſenſible ſecondary qualities, which are nothing but powers to produce ſeveral ideas in us, by our ſenſes. Thirdly, the aptneſs we conſider in any ſubſtance, to cauſe or receive ſuch alterations of primary qualities, as that the ſubſtance ſo altered, ſhould produce in us different ideas from what it did before; and they are called active and paſſive powers: all which, as far as we have any notice or notion of them, terminate in ſimple ideas.

Beſides the complex ideas we have of material ſubſtances by the ſimple ideas taken from the operations of our own minds, which we experiment in ourſelves, as thinking, underſtanding, willing, knowing, &c. co-exiſting in the ſame ſubſtance, we are able to frame the complex idea of a ſpirit; and this idea of an immaterial ſubſtance is as clear as that we have of a material one. By joining theſe with ſubſtance, of which we have no diſtinct idea, we have the idea of ſpirit; and by putting together the ideas of coherent, ſolid parts, and a power of being moved, joined with ſubſtance, of which likewiſe we have no poſitive idea, we have the idea of matter.

Further, there are other ideas of ſubſtances, which may be called collective; which are made up of many particular ſubſtances conſidered as united into one idea, as a troop, army, &c. which the mind makes by its power of compoſition. Theſe collective ideas are but the artificial draughts of the mind, bringing things, remote and independent, into one view, the better to contemplate and diſcourſe of them united into one conception, and ſignified by one name: for there are no things ſo remote, which the mind cannot, by this art of compoſition, bring into one idea; as is viſible in that ſignified by the name univerſe.

SUBSTANTIAL, in the ſchools, ſomething belonging to the nature of ſubſtance.

It is generally diſputed, whether or no there be ſuch things as ſubſtantial forms? i. e. forms independent of all matter; or forms that are ſubſtances themſelves.

Subſtantial is alſo uſed in the ſame ſenſe with eſſential, in oppoſition to accidental.

SUBSTANTIVE, in grammar, a noun, or name, conſidered ſimply and in itſelf, without any regard to its qualities, or other accidents, in contradiſtinction to the noun termed adjective, or that which expreſſes a certain quality or accident of the noun ſubſtantive. Or, a noun ſubſtantive is that noun, which, joined to a verb, makes a perfect ſentence, as *a man*, *a horſe*, *a tree*; thus *a man laughs*, *a horſe gallops*, *a tree buds*, are each of them perfect ſentences. All nouns, to which one cannot add the word *thing*, are ſubſtantives; and thoſe to which *thing* may be added, are adjectives.

SUBSTITUTE, a perſon appointed to officiate for another, in caſe of abſence, or other legal impediment.

SUBSTITUTE, in medicine, denotes a drug or remedy that may be uſed inſtead of another; or that ſupplies the place of another, of like virtue, which is not perhaps to be had: called alſo ſuccedaneum.

SUBSTITUTION, in grammar, the uſing of one word for another, or one mode, ſtate, perſon, or number of a word for another.—This the grammarians otherwiſe call ſyllepſis.

SUBSTITUTION, in algebra, &c. is the putting, in the room of any quantity in an equation, ſome other quantity which is equal to it, but expreſſed after another manner.

SUBTANGENT *of a Curve*, the line that determines the interſection of a tangent with the axis; or, that determines the point, wherein the tangent cuts the axis, prolonged.

Thus, the ſubtangent of the curve V M D plate CXXIII. *fig.* 3. is T P, determining the interſection of the tangent, and the axis or diameter continued.

In any equation, if the value of the ſubtangent comes out poſitive, it is a ſign that the points of interſection of the tangent and axis fall on that ſide of the ordinate, where the vertex of the curve lies; as in the parabola and paraboloids: but, if it comes out negative, the point of interſection will fall on the contrary ſide of the ordinate, in reſpect of the vertex or beginning of the abſciſſa; as in the hyperbola and hyperboliform figures. And, univerſally in all paraboliform and hyperboliform figures, the ſubtangent is equal to the exponent of the power of the ordinate multiplied into the abſciſſa.

If C B *fig.* 4. be an ordinate to A B in any given angle terminating in any curve A C, and A B $= x$, B C $= y$, and the relation between x and y, that is, the nature of the curve, be expreſſed by this equation, $x^3 - 2xxy + bxx - bbx + byy - y^3 = 0$, then this will be the rule of drawing a tangent to it: multiply the terms of the equation by any arithmetical progreſſion; according to the dimenſions of y, ſuppoſe

$x^3 - 2xxy + bxx - bbx + byy - y^3$; as

0 1 0 0 2 3

alſo according to the dimenſions of x, as,

$x^3 - 2xxy + bxx - bbx + byy - y^3$

3 2 2 1 0 0

the former product ſhall be the numerator, and the latter, divided by x, the denominator of a fraction expreſſing the length of the ſubtangent B D, which, in this caſe, will be $= \frac{-2xxy + 2byy - 3y^3}{3xx - 4xy + 2bx - bb.}$

SUBTENSE, in geometry, the ſame with chord. See CHORD.

SUBTERRANEOUS, or SUBTERRANEAN, ſomething under-ground.

The word is formed from the Latin, *ſub*, under, and *terra*, the earth.

SUBTILE, in phyſics, intimates a thing exceedingly ſmall, fine, and delicate; ſuch as the animal ſpirits, the effluvia of odorous bodies, &c. are ſuppoſed to be.

SUBTRACTION, or SUBSTRACTION, in arithmetic, is the rule by which one number is deducted from, or taken out of, another, that ſo the remainder, difference or exceſs, may be known.

The word is Latin, *ſubſtractio*, and is derived from *ſub* and *traho*, to draw.

Thus, 6 taken out of 9, there remains 3. This 3 is also the difference betwixt 6 and 9, or it is the excess of 9 above 6.

Therefore the number or sum out of which subtraction is required, must be greater, or at least equal to the subtrahend, or number to be subtracted.

Note. This rule is the converse or direct contrary to addition.

And here the same caution that was given in addition of placing figures directly under those of the same value, viz. units under units, tens under tens, and hundreds under hundreds, &c. must be carefully observed; also, underneath the lowest rank there must be drawn a line, to separate the given numbers from their difference, when it is found.

Then, having placed the lesser number under the greater, the operation may be thus performed.

Rule. Begin at the right-hand figure or place of units, as in addition, and subtract the lower figure from the figure that stands over it, setting down the difference underneath the same; if the two figures chance to be equal, set down a cypher. But, if the upper figure be less than the lower, then you must add 10 to the upper figure more than it is, and from that sum subtract the lower figure, setting down the remainder, as before directed. Now, because the 10, thus added, was supposed to be borrowed from the next superior place, viz. of tens, in the upper figures, therefore you must call the next lower figure one more than it really is, and then proceed to subtract in that place as in the former; and so gradually on from one row of figures to another, until all be done.

Examp. 1. Let it be required to find the difference between 6785 and 4572. — That is, let 4572 be subtracted from 6785. These numbers, being placed down as before directed, will stand

Thus { 6785
       4572
       2213.

Beginning at the place of units, take 2 from 5 and there will remain 3, which must be set down underneath its own place; and then proceed to the place of tens, taking 7 from 8 and there will remain 1, to be set down underneath its own place; again, at the place of hundreds, take 5 from 7 and there remains 2, which is set down in its place; lastly, take 4 from 6 and there remains 2, which being set underneath its own place, the work is finished, and the difference so found will be 2213 = 6785 — 4572, as was required.

Example 2. The difference between 5849 and 7946 is required?

7946
5849
2097.

Having placed the figures as above, begin at the units place, and say 9 from 6 cannot be, but from 16 (as above directed) and there remains 7 to be set down under its own place; next proceed to the place of tens, and add 1 to the lower figure, which will pay the 10 you added to the former 6 to make it 16. This being done, the lower figure in the place of tens, which is 4, will be 5, which you must subtract from the figure above, saying 5 from 4 cannot be, but from 14 (by adding 10 to it) and there will remain 9, which must be put down in its place; then adding 1 to the next lower figure 8, in the place of hundreds, for the last 10 added, it will be 9, which taken or subtracted from the figure above it, which is 9, and there remains 0, which must be set down in its place; and proceed to the last, saying 5 from 7 and there remains 2, which being set down under its own place, all is done, and the difference required will be 2097 = 7946 — 5849.

SUBTRACTION *of divers Denominations*, as of money, &c.—Begin with the lowest or least denomination, and subtract the figure or figures in that place, from the figure or figures that stand over them of the same denomination, setting down the remainder; but if the lower figure be greater than that above it, you must increase the upper figure by adding to it one of the next superior denomination, and from that sum subtract, and then proceed to the next superior denomination, and add one to the lower figure for what you borrowed, as in whole numbers.

	l.	*s.*	*d.*		*l.*	*s.*	*d.*
From	386	9	8	From	569	10	6
Take	173	4	6	Sub.	389	15	8
	213	5	2		179	14	10

The first of these examples is self-evident; in the second example, beginning at the place of pence, being the least denomination, I am to take 8 from 6, but as that cannot be done, I must, according to the rule, borrow one of the next denomination, viz. 1 *s.* and add it to the 6 *d.* which makes it 18 *d.* then I take 8 *d.* from it, and there remains 10 *d.* to be set down underneath the place of pence; that done, I proceed to the place of shillings, carrying 1 to the lower figure 15 for what I borrowed, which makes it 16, which from ten cannot be got; but from 30, by borrowing one of the next denomination, viz. 1 *l.* and there remains 14, which having set down in its proper place, I proceed to the place of pounds, where carrying the 1 I borrowed to 9 makes 10 from 19, and there remains 9; and so on as in whole numbers till all be finished.

SUBTRACTION *of Algebra*, is performed by the following general rule.—Change the signs of the quantity to be subtracted into their contrary signs, and then add it, so changed, to the quantity from which it was to be subtracted, and the sum arising by this addition is the remainder. For to subtract any quantity positive, or negative, is the same as to add the opposite kind.

Example. From	$+5a$	$8a - 7b$
Subtract	$+3a$	$3a + 4b$
Remainder	$5a - 3a$, or $2a$	$5a - 11b$

From	$2a - 3x + 5y - 6$
Subtract	$6a + 4x + 5y + 4$
Rem.	$-4a - 7x \quad 0 - 10.$

It is evident, that to subtract or take away a decrement is the same as adding an equal increment. If we take away $-b$ from $a - b$, there remains a; and if we add $+b$ to $a - b$, the sum is likewise a. In general, the subtraction of a negative quantity is equivalent to adding its positive value.

SUBTRIPLE *Ratio*, is when one number or quantity is contained in another three times.

Thus, 2 is said to be the subtriple of 6, and 6 the triple of 2.

SUBULATED, something in the shape of an awl: thus, a subulated leaf is one of an oblong and narrow figure, broadest at the base, and thence gradually decreasing, till it terminates in a point.

SUCCEDANEUM, in pharmacy, a remedy substituted in the place of another first prescribed, when the ingredients are wanting necessary for the composition of that other.

The word is formed from the Latin, *succedo*, to succeed, or come after.

SUCCESSION, *Successio*, in philosophy, an idea which we get by reflecting on that train of ideas constantly following one another in our minds, when awake. See IDEA.

SUCCESSION, in law, implies a right to the whole effects left by a defunct.

SUCCULA, in mechanics, a bare axis, or cylinder, with staves to it round, but without any tympanum or peritrochium.

SUCKERS, in gardening, the same with off-sets. See OFF SETS.

SUCTION, *Suctio*, the act of sucking or drawing up a fluid, the air, water, milk, or the like, by means of the mouth and lungs.

There are many effects vulgarly attributed to suction, which, in reality, have very different causes. As when

any one ſucks water, or any other liquor, up thro' a pipe, it is commonly thought, that by that action the perſon draws the air up into his mouth, and that the water, which is contiguous to it, follows it by a kind of attraction, as if the air and water hung together; and others fancy, that the air moves into the mouth of the ſucker, and the water moves up after the air, to prevent a vacuum, which, they ſay, nature abhors: whereas the true cauſe of this phænomenon is only, that the air and atmoſphere preſſes, with its whole weight, uniformly on the ſurface of the liquor in the veſſel; and, conſequently, prevents any one part of the water to riſe higher than the other there: and if a pipe be put in, of any tolerable large bore, and be open at both ends, the water will riſe within the pipe to the ſame height as without, and indeed, a little higher, becauſe the preſſure of the air within the pipe is a little taken off by bearing againſt the ſides of the pipe. Now when any one applies his mouth to the upper end of the pipe, and ſucks, his lips ſo ſtrongly incloſe the pipe, that no air can get between them and it; and by the voluntary motion of the ſpirits in the muſcles, the cavity of his thorax, or breaſt, is opened and enlarged; by which means the air, included there, hath now a much larger ſpace to dilate itſelf in, and, conſequently, cannot preſs ſo ſtrongly againſt the upper end of the pipe, as it did before the cavity of the thorax was ſo enlarged, and when the weight of the whole atmoſphere kept its ſpring bent. And that weight or preſſure being now taken off by the lips of the man that ſucks, the equilibrium is deſtroyed, the air gravitates on the ſurface of the water, but cannot do ſo on the upper orifice of the pipe, becauſe the juncture of the lips takes it off; and the ſpring of the air included in the thorax, being weakened by the dilation of its cavity, it cannot preſs ſo hard againſt the upper orifice of the pipe, as the water will do againſt the lower, and, conſequently, the water muſt be forced up into the pipe. It is much the ſame thing in the ſuction of a common pump: the ſucker being tight, takes off entirely the preſſure of the atmoſphere on the ſurface of the water within the barrel of the pump; and, conſequently, the atmoſphere, by its weight, muſt force the water up to make the equilibrium.

SUDAMINA, little heat pimples in the ſkin, like the millet-grains, frequent in youth, eſpecially thoſe of a hot temperament, and that uſe much exerciſe.

SUDATORY, a name given by the ancient Romans to their hot or ſweating rooms; ſometimes, alſo, called Laconica.

SUDOR ANGLICANUS, the ſweating-ſickneſs, a diſeaſe ſo called from its appearing firſt in England, in the year 1483.

It ſeized different patients in different manners; for in ſome it firſt appeared with a pain in the neck, ſcapula, legs, or arms; whilſt others perceived only a kind of warm vapour, or flatulence, running through thoſe parts. And theſe ſymptoms were ſuddenly ſucceeded by a profuſe ſweat, which the patient could not account for. The internal parts became firſt warm, and were ſoon after ſeized with an incredible heat, which thence diffuſed itſelf to the extremities of the body. An intolerable thirſt, reſtleſsneſs, and indiſpoſition of the heart, liver and ſtomach, were the next ſymptoms, which were ſucceeded by an exceſſive head-ach, or delirium, in which the patient was very trifling and talkative; and after theſe, a kind of extenuation of the body, and an irreſiſtible neceſſity of ſleeping.

For preventing this diſeaſe, temperance is ordered, and the choice of ſalutary aliments and drinks. No crude pot-herbs nor ſallads are to be uſed, becauſe they may have received a noxious quality from the air; or, if they are uſed, they are to be previouſly waſhed with warm water.

SUDORIFIC, in medicine, a remedy that cauſes or promotes ſweat.

The word is formed from the Latin *ſudor*, ſweat, and *facio*, to cauſe.

SUET, *Sevum*, or *Sebum*, in anatomy, the ſolid fat found in ſeveral animals, as ſheep, oxen, &c. but not in the human ſpecies.

SUFFITUS, in medicine, the ſame with fumigation. See FUMIGATION.

SUFFOCATION, in medicine, the privation of reſpiration, or breathing; which is ſometimes occaſioned by a congeſtion of blood in the lungs, ſo as to prevent the ingreſs of the air.

The fumes of wine, or other ſtrong liquors, when boiling, likewiſe cauſe ſuffocation; as do the fumes of lime, charcoal, antimony, ſulphur, vitriol, ſpirit of nitre, &c.

SUFFOCATION *of the Womb*, or *Matrix*, is a diſeaſe pretty frequent in women, called alſo fits of the mother.

In this the patient imagines a malignant vapour riſing from the matrix, and ſo preſſing againſt the lungs and diaphragm, as to prevent the free motion neceſſary to reſpiration.

SUFFOCATIVE CATARRH. See the article CATARRH.

SUFFRAGAN, an appellation given to ſimple biſhops, with reſpect to archbiſhops, on whom they depend, and to whom appeals lie from the biſhop's courts.

SUFFRAGE, *Suffragium*, a voice or vote given in an aſſembly where ſomething is deliberated on, or where a perſon is elected to an office or benefice.

SUFFUMIGATION, or FUMIGATION. See FUMIGATION.

SUFFUSION, in medicine, the ſame with cataract. See CATARACT.

SUGAR, *Saccharum*, a very ſweet agreeable ſubſtance, extracted from a kind of canes, or reeds, growing in great plenty in both the Eaſt and Weſt-Indies.

Sugar grows in a long ſtalk, which is called a cane, full of joints, two, three, four, or five inches aſunder, and about ſix foot high, the ſpouts and leaves of which riſing up ſo high, as may make it near eight feet in all. The body of the cane is about an inch in diameter, ſeldom more; the colour of the cane-tops is a pure graſs-green; the cane itſelf is yelloviſh when ripe: it is covered with a thin ſkin or bark, ſomewhat hard on the inſide, being of a white ſpungy ſubſtance, full of juice, which the inhabitants of Jamaica ſuck and eat in great quantities, without injuring their health: nothing is pleaſanter than this ſap, when the cane is ripe; it is alſo very nouriſhing and wholeſome, if taken with moderation. Their way of eating it is thus: they cut the ſkin or rind off, and put the pile or ſpungy parts into their mouths, when the juice will come out more freely than honey out of the comb: it is not ſurfeiting, but the cleaneſt and beſt ſweet in the univerſe. The nature of this juice is much like to that of apples, but ſomething thicker; it is yellow when the cane is ripe, clean, and without any ill taſte or ſmell, and goes off the palate as ſweetly as it came on. Of this juice, ſugar, rum, and melaſſes are made.

The ſeaſon for planting ſugar-canes, is from Auguſt to the beginning of December; which do not arrive to maturity, till they have been a year and a quarter, or eighteen months in the ground.

Their manner of growing is in ſprouts, three, four, or five from one root. They are not all of a ſize, either in bigneſs or length, according to the goodneſs of the ſoil, and the ſeaſons. Some canes will not riſe above three feet high, and others ſix, and the flags or cane tops of them exceed that ſtalk and all, and ſometimes are under ſix. Theſe cane-tops make very good food for horſes and black cattle; but the ſolid canes are carried to the mill, for the uſes we ſhall mention hereafter.

The manner of planting them, is by digging long trenches in the earth, about ſix inches deep, and as many broad, and laying a double row of canes along in the trench one by another, from one end of the trench to the other; then the earth is thrown in, and another trench dug, and ſo another, at about two feet diſtance, till all the land is planted, by laying the canes along: thus they produce the greater number of ſprouts; for this way, a branch ſhoots out of every joint of the cane, whereas the firſt planters uſed to thruſt a piece of cane perpendicularly into a hole, at certain diſtances, which yielded

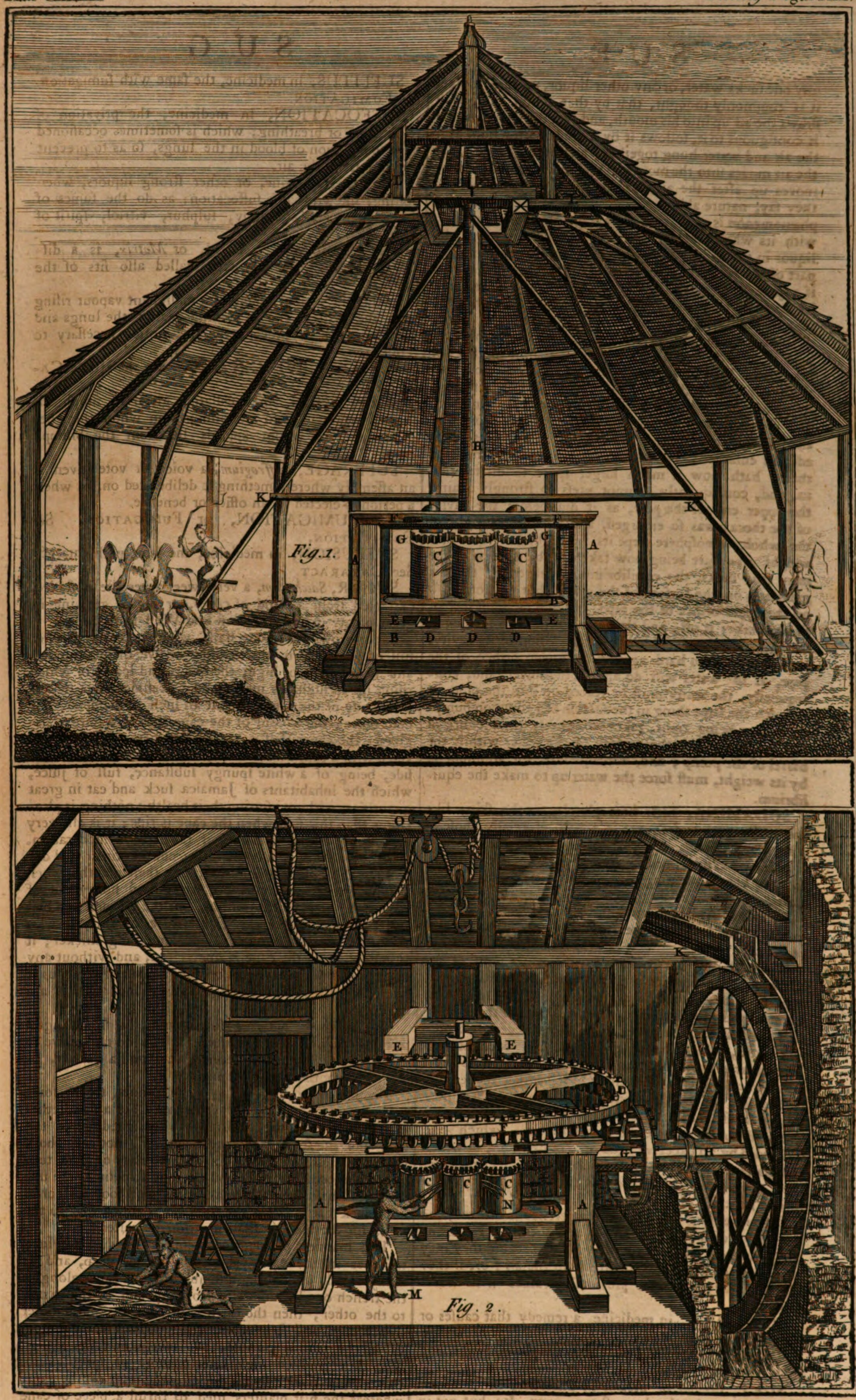
H
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Fig. 1.
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Fig. 2.

yielded no shoot but from the top, and having three or four sprouts, whole whole weight depended on one root. when they grew tall and heavy, the thorns fastened the roots, and so they rotted, and became good for nothing. By this new way of planting the root is secured, and the produce increased. They come up in a little while after they are planted, and in about twelve weeks they will be two feet high.

The next care of the planter, is to keep the canes well weeded, weeds being very apt to spoil and stop them, and formerly the withes in particular, a deeper than mais along the ground, and fastens to the canes, by which they hinder their growth.

The roots must also be examined, to see if any have failed, that they may be supplied, at once with others, left the ground should yield nothing morelat to the plant.

The practice now is to dung the canes which is done either when they are planted, or when they come up, and are two feet high; and this is the greatest trouble and expence the planter is at; for if it was not for this dunging, a third part of the negroes would do his buthers.

When the canes are ripe, which is known by their colour, they are cut up with a bill, or other tool, by one stroke; for if they are too big to be moved with a feythe, or cut with a hook. As they cut them, they trim them, chop off the top, and cut or strip off the leaves or flags on the sides, which are saved for the use we have already observed.

The canes thus cut, are bundled up in faggots, and tied up with the tops of the canes; they are then carried to the mill by negroes, in carts, or drawn by horses.

The mills that are mostly used at Jamaica, are cattle mills, but lately, some substantial planters have one or two wind-mills, and some three. The late prudent Alcough erected one on his plantation to windward, which is very curious.

The cattle-mills, water-mills and wind-mills, are made after the same manner as those in England, and they grind the canes thus in the cattle-mills: the horses and cattle being put to the teeth, go round, and so by sweeps the middle roller, which being cogged at the upper end, turn the spurs above them, and so the rollers in the mill by which means the canes are squeezed between them through the holes at the bottom of the upper cross upon the same manner as in a sugar-mill. The second device is to bring it to sing-water, carrying it with his hand when the canes are put in between the rollers, and so it comes through them on the other side, and is received in a cistern. A good draught for five acres of canes in one year, is a woman puts in the canes on one side, and receives them through on the other, and returns them through on the other side, and receives them, and returns them on the other way.

This operation prelles out the juice; and the English do no more to the canes; but the Spaniards have a press to squeeze out the remainder of the liquor, after both the former grindings. Their works are small, and so not willing to make the most of them.

Mr. Ligon, from whom some part of this account of the cattle-mill is taken, speaks more largely of it; but what we have said, may give the reader some idea of the machine. The rollers are of wood, cased with iron, and they press out the juice to throughly, that there is no occasion of a press to squeeze them; for in an hour's time the sun dries the canes so much, that they are fit to burn. Under the rollers there is a hollow place, into which all the juice that runs from the canes is received, and by pipes of lead, or leaden gutters covered close over, conveyed into a cistern.

When sugar was first cultivated in this island, one acre of canes yielded more than now, for four, five, six, or seven years together, without any further planting or dunging; the same root would shoot forth new branches, and those be fuller of sap than the canes are at this time, causing such a quantity of rich juices, and the canes preffing it so often with the same plant, and never letting it lie fallow, the soil is so impoverished, that they are now obliged to dung and plant every year; insomuch that a

hundred acres of cane require almost double the number of hands they did formerly, while the land retained its natural vigour, which also then, did not only bring forth certain crops, but fewer weeds too, the weeds having been increased by frequent dunging.

Most of the sugar islands, Jamaica especially, have a kind of white earthy gravel, called marle, two or three feet deep, which of itself is of so hot a temper, and so intermixed to much by dunging, that their crops in all dry seasons are sure to fail, and on the other hand, in a wet year, the canes grow rank, and never come to maturity.

When the sugar is in the cistern, it will not remain there above one day, but is drawn from thence it is conveyed through a gutter, into the boiling-house, and there received into the first copper, in the middle of the battery, which is the largest copper in the house, and is placed next to the wall of the boiling-house, and the gutter entering in the top of the copper, it is taken out of the copper, and put into a second, and so into a third, and fourth, and fifth, all the battery being placed in a row, and so it is carried through the whole at the bottom of the copper at the top. The second device is to bring it to sing-water, carrying it with his hand when the canes are put in between the rollers, and so it comes through them on the other side, and is received in a cistern. A good draught for five acres of canes in one year, is a woman puts in the canes on one side, and receives them through on the other, and returns them on the other way.

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yielded no ſhoot but from the top; and having three or four ſprouts, whoſe whole weight depended on one root, when they grew tall and heavy, the ſtorms looſened the roots, and ſo they rotted, and became good for nothing. By this new way of planting the root is ſecured, and the produce increaſed. They come up in a little while after they are planted, and in about twelve weeks they will be two feet high.

The next care of the planter, is to keep the canes well weeded, weeds being very apt to grow among them; and formerly the withes in particular, a creeper that runs along the ground, and faſtens to the canes, by which they hinder their growth.

The roots muſt alſo be examined, to ſee if any have failed, that they may be ſupplied in time with others, leſt the ground ſhould yield ſomething hurtful to the plant.

The practice now is to dung the canes, which is done either when they are planted, or when they come up, and are two feet high; and this is the greateſt trouble and expence the planter is at; for if it was not for this dunging, a third part of the negroes would do his buſineſs.

When the canes are ripe, which is known by their colour, they are cut up with a bill, or other tool, by one atatime; for if they are too big to be moved with a ſcythe, or cut with a hook. As they cut them, they trim them, chop off the top, and cut or ſtrip off the leaves or flags on the ſides, which are ſaved for the uſes we have already obſerved.

The canes thus cut, are bundled up in faggots, and tied up with the tops of the canes; they are then carried to the mill by aſſinegoes, in carts, or drawn by horſes.

The mills that are moſtly uſed at Jamaica, are cattle mills; but lately, ſome ſubſtantial planters have one or two wind-mills, and ſome three. The late preſident Aſcough erected one at his plantation to windward, which is very curious.

The cattle-mills, water-mills, and wind-mills, are made after the ſame manner as thoſe in England, and they grind the canes thus in the cattle-mills: the horſes and cattle being put to their tackle, go about, and turn by ſweeps the middle roller; which being cogged at the upper end, turn the others about. They all three turn upon the ſame centers, which are of braſs and ſteel, going ſo eaſily of themſelves, that a man taking hold of one of the ſweeps with his hands, may turn all the rollers about; but when the canes are put in between the rollers, it is a good draught for five oxen or horſes. A negro-woman puts in the canes on one ſide, and the rollers draw them through on the other, where another negro-woman ſtands, receives them, and returns them back on the other ſide of the middle roller, which draws the other way.

This operation preſſes out the juice, and the Engliſh do no more to the canes: but the Spaniards have a preſs to ſqueeze out the remainder of the liquor, after both the former grindings. Their works are ſmall, and ſo are willing to make the moſt of them.

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When ſugar was firſt cultivated in this iſland, one acre of canes yielded more than now, for four, five, ſix, or ſeven years together, without any further planting or dunging; the ſame root would ſhoot forth new branches, and thoſe be fuller of ſap than the canes are at this time; when the ſugar being of ſo great a ſubſtance, and containing ſuch a quantity of rich juices, and the planters preſſing it ſo often with the ſame plant, and never letting it lie ſtill, the ſoil is ſo impoveriſhed, that they are now obliged to dung and plant every year; inſomuch that a hundred acres of cane require almoſt double the number of hands they did formerly, while the land retained its natural vigour, which alſo then, did not only bring forth certain crops, but fewer weeds too, the weeds having been increaſed by frequent dunging.

Moſt of the ſugar iſlands, Jamaica eſpecially, have a kind of white chalky gravel, called marle, two or three feet deep, which of itſelf is of ſo hot a temper, and is increaſed ſo much by dunging, that their crops in all dry ſeaſons are ſure to fail; and, on the other hand, in a wet year, the canes grow rank, and never come to maturity.

When the liquor is in the ciſtern, it muſt not remain there above one day, leſt it grow ſour: from thence it is conveyed through a gutter, fixed to the walls of the boiling houſe, to the clarifying copper or boiler; and there boiled, till all the filth or groſs matter riſing in the top is ſkimmed off. This is the largeſt copper in the boiling-houſe; and as the liquor is refined, it is taken out of the copper, and carried into the ſecond, and ſo into a third, fourth, fifth, ſixth, and ſeventh. The leaſt is called the tach, where it boils longeſt. It is continually kept ſtirring till it comes to a conſiſtency; and yet all this boiling would reduce it only to a thick clammy ſubſtance, without turning it to a grain, were it not for the temper that is thrown into it. This ley or temper was many years ago made of the aſhes of withes, which in the field was ſo deſtructive to the cane; the temper now uſed, is made of lime infuſed in common water. When the ſugar begins to riſe up with a turbulent ungovernable fury, occaſioned by the fermentation of the liquor of the lime-water, and the vehement heat of the fire, to prevent its running over, they throw in a ſmall piece of tallow no bigger than a nut. This preſently makes it fall.

From the boiler the liquor is emptied into a cooler, where it remains till it is fit to be potted. Theſe pots are wide at top, and taper downwards, where a hole is left for the molaſſes to drain. The hot liquor would run out, but the pots are ſtopt with a twig till they are ſet upon the dripps. In refining the ſugar, the firſt degree of pureneſs is effected by permitting the molaſſes to drain away through the hole at the bottom of the ſugar-pots, they being all the time open at the top. The ſecond degree is procured by diſſolving it in lime-water, clarifying it, and boiling it down to a due conſiſtence: after which it is poured again into the ſugar-pots, having their lower holes ſtopped with plugs. When the ſugar has concreted into a maſs, the liquid part is drained off by the aperture; and ſome fine clay, ſoftened with water into a paſte or batter, is ſpread upon the upper broad ſurface: the moiſture of the clay ſlowly imbibed by, and percolating through, the ſugar, carries down with it great part of the remains of the treacly matter.

The clayed ſugar imported from America, is by our refiners diſſolved in water, the ſolution clarified with whites of eggs, and after due inſpiſſation, poured as before into conical moulds, where as ſoon as the ſugar has concreted, and the fluid part is drained off by the aperture at the bottom, the ſurface of the loaf is again covered with moiſt clay. The ſugar, thus refined, becomes, by a repetition of the proceſs, the double refined ſugar of the ſhops.

Sugar diſſolves, by the aſſiſtance of heat, in rectified ſpirit; but greateſt part of it ſeparates again in the cold, and concretes into a cryſtalline form: on this foundation ſaccharine concretions are obtained from ſaturated ſpirituous tinctures of ſeveral of the ſweet plants of our own growth; the ſaccharine part ſeparating when the tincture is ſet in the cold, while the reſinous or other matter extracted from the plant, remains diſſolved in the ſpirit. Solutions of ſugar mingle uniformly with thoſe of other ſaline ſubſtances, whether acid, alcaline, or neutral; and make no viſible alteration in the infuſions of the coloured flowers of vegetables, or other liquors, in which acids or alcalies produce a change of colour or a precipitation. This ſweet ſaline ſubſtance appears on all trials completely neutral; and unites with moſt kinds of humid bodies, without altering their native qualities: it ſerves as an intermedium for uniting together ſome bo-

dies

dies naturally repugnant, as diſtilled oils and water. On the ſame principle it impedes the coagulation of milk, and the ſeparation of its butyraceous part.

Sugar, in conſequence of this property, is ſuppoſed to unite the unctuous part of the food with the animal juices. Hence ſome have concluded, that it increaſes corpulence or fatneſs; others, that it has a contrary effect, by preventing the ſeparation of the oily matter, which forms fat, from the blood; and others, that it renders the juices thicker and more ſluggiſh, retards the circulation, obſtructs the natural ſecretions, and thus occaſions or aggravates ſcorbutic, cachectic, hypochondriacal, and other diſorders. General experience, however, has not ſhewn, that ſugar produces any of theſe effects in any remarkable degree: its moderate uſe appears to be innocent; and perhaps, of all that have yet been diſcovered, it is the moſt univerſally innocent and inoffenſive, as well as the moſt ſimple, ſweet.

Sugar preſerves both animal and vegetable ſubſtances from putrefaction, and appears to poſſeſs this power in a higher degree than the common alimentary ſalt; animal fleſh having been preſerved by it untainted for upwards of three years. From this it has been ſometimes applied externally as a balſamic and antiſeptic. The impure brown ſugars, by virtue of their oily or treacly matter, prove emollient and gently laxative. The uſes of ſugar in medicinal compoſitions, whether for their preſervation, for procuring the intended form and conſiſtence, or for reconciling to the ſtomach and palate ſubſtances of themſelves diſguſtful, are too obvious to require being enlarged on.

Sugar was known to the antients; Dioſcorides and Galen called it ſaccharum, and Theophraſtus mel in arundinibus, honey in reeds. Arrian alſo calls it mel arundineum, and Ægineta ſal Indicus, Indian ſalt. Notwithſtanding, however, that the ancients were all acquainted with ſugar, they did not bring it into common uſe as we do. All their writers, however, mention it as a thing known. Strabo ſays, that Indian honey, as he calls it, was produced without bees. Lucan ſpeaks of the honey-juice of reeds; and Varro tells us, that a ſweet juice was expreſſed from the Indian reeds, and was equal to honey. Seneca tells us of honey found in reeds, in India, and is in ſome doubt whether it was a honey-dew, as they ſuppoſed manna to be, or whether it was the genuine product of thoſe reeds. The Greeks indifferently called the ſugar of thoſe times by the names of honey, ſalt, and ſugar.

Dioſcorides makes it a kind of honey, and ſays, that, beſides the common honey, there was another ſort called ſaccharum, which was found in reeds, in Arabia and the Indies, and was like a ſalt, hard and brittle under the teeth. Pliny alſo agrees that there were ſugar-canes in Arabia, which produced ſugar like thoſe of the Indies, but that it was inferior to that of India.

We find by all their accounts, that they knew the ſweet juice of theſe reeds, and that they alſo ſometimes, had ſent over to them concreted granules of real ſugar, which had exſudated from the reeds, and dried in the ſun to a hardneſs; theſe were the pieces of ſugar which Dioſcorides mentions, as crackling under the teeth. And others tell us they were of the ſize of a pea, or at the moſt of a horſe-bean. It is plain, however, that they knew nothing of the art of making ſugar by boiling the juice.

As plain as it appears that the ancients not only knew ſugar, but knew alſo it was produced from reeds, it does not yet appear, however, whether they knew the very ſpecies of reed which we now cultivate, and call the ſugar-cane, or not. It is very certain, that there are other plants which may be called canes and reeds, and which produce ſugar, in the Indies, as well as this: the bambu-cane, in particular, is remarkable, not only for producing ſugar, but for having it exſude and concrete in granules on its ſurface, though in no great quantity. The Indians call this ſacchar manna, but they do not boil its juice.

Salmaſius, from Varro and ſome other of the ancients, talking of the Indian ſugar-cane, as growing to the height of a moderate tree, ſeems poſitive, that the bambu was the only kind they knew; but though it may appear evidently enough from this, that they knew the mambu or bambu, it does not appear hence that they did not alſo know the common ſugar reed of our times; which, indeed, it ſeems, in ſome meaſure, proved that they did, by Lucan's calling it the tenera arundo, a term no way applicable to the bambu.

The native ſugar, or the concreted juice of the ſugar-cane produced by mere exſudation, and hardened on its bark, was more frequent in the ancient times than now, becauſe older and larger reeds are more diſpoſed to produce it. It was alſo more careſully collected, when there was no other to be had; but now that the canes are cut down at a year's growth, and the ſugar procured in ſuch infinitely greater quantities by boiling, it is not wonderful that little of the native ſugar is produced, or what there is, is but little regarded.

The Arabians all mention three kinds of ſugar: 1. Saccharum arundineum of Avicenna, which was found naturally exſudated on the ſugar-canes now propagated. 2. The tabaxir of the ſame author, which was the native ſugar of the bambu: it appears probable, that all theſe authors underſtood, by the ſame name, a coarſe kind of ſugar produced by art, for they ſpeak ſometimes of tabaxir reſembling aſhes, and imagined it to be the aſhes of the ſugar-canes. 3. The ſacchar alhuſar; or alhaſter. This they alſo called manna. It differed from the common ſugar in many reſpects; it had little ſweetneſs, but much of a bitteriſh taſte. It exſudated from the plant they call alhuſa, in the ſame manner as their manna did from the alhagi; and they, therefore, called it manna. This ſugar is not now known in Europe, but in Egypt and Arabia they are well acquainted with it. The plant it exſudates from is the beid-el-oſſar of Proſper Alpinus. The ſugar produced by this plant was, indeed, probably, very different from that of the ſugar-cane; this being of the apocynum or dog-bane kind, and its juice ſo acrid, as to be uſed as a depilatory.

In ſome parts of North America, particularly in Canada, a kind of ſugar is prepared from the juice which iſſues upon wounding or boring certain ſpecies of the maple-tree, one of which is named from hence the ſugar maple; as alſo from the wild or black birch, the honey-locuſt, and the hickery. The maple is moſt commonly made uſe of for this purpoſe, as being the richeſt, and as beſt enduring the long and ſevere winters of that climate. The juice is boiled down, without any addition, to a thick conſiſtence, then taken off from the fire, kept ſtirring till its heat is abated, and ſet in a cold place; where the ſugar quickly concretes into grains, reſembling common brown ſugar.

The trees are topped early in the ſpring about the time that the ſnow begins to melt: it is obſervable, that when the weather begins to grow warm, they bleed no more; and that after the bleeding has ſtopt, they begin to run again upon covering the roots with ſnow. The more ſevere the winter has been, the juice is found to be richer and in greater quantity. The trees which grow on hills, or high lands, yield a richer juice than thoſe which are produced in low countries; and the middle-aged than the young or the old.

Mr. Kalm informs us, in the Swediſh Tranſactions for the year 1751, that one tree, if the ſummer does not come on haſtily, will yield about forty-two gallons of juice, Engliſh wine meaſure, and that the quantity which iſſues in one day is from three to ſix gallons: that eleven gallons of juice of middling quality give a pound of ſugar, and that ſometimes a pound has been gained from three gallons and a half: that two perſons can in one ſpring prepare commodiouſly two hundred pounds. He obſerves that this ſugar is weaker than that from the ſugar-cane, but that for ſome perpoſes it anſwers better, as for chocolate and preſerves. It is likewiſe eſteemed more medicinal: conſiderable quantities are brought annually into Europe, particularly France, and there employed in diſorders of the breaſt. It is reckoned that a pound of common ſugar goes as far in ſweetening as two pounds of maple ſugar.

The large maple, commonly called ſycamore-tree, bleeds alſo in Europe a ſweet juice, from which an actual ſugar has been prepared. In the Tranſactions above-mentioned, for the year 1754, there is an account of

ſome experiments made in this view upon the Swediſh maple. Eight trees, none of them under thirty years, bled, in four days, fourteen gallons of juice, which inſpiſſated gave two pounds and a half of brown ſugar. Another time, the ſame eight trees bled, in three days, ten gallons and a half, which yielded one pound four ounces of ſugar, with half a pound of ſyrup. It is the ſaccharine juice of the maple-tree, which, exſuding upon the leaves, renders them ſo apt to be preyed upon by inſects.

The common birch bleeds alſo a large quantity of a ſweetiſh juice, which yields on being inſpiſſated a ſweet ſaline concrete, not however perfectly of the ſaccharine kind, but ſeeming to approach more to the nature of manna.

There are ſundry other vegetables, raiſed in our own country, which afford ſaccharine concretes; as beet roots, ſkirrets, parſnips, potatoes, celery, red cabbage-ſtalks, the young ſhoots of Indian-wheat, &c. The ſugar is moſt readily obtained from theſe, by making a tincture of the ſubject in rectified ſpirit of wine; which when ſaturated by heat will depoſite the ſugar upon ſtanding in the cold.

SUGAR-MILL, a machine for bruiſing the ſugar canes, in order to extract their juice, for making ſugar.

We have already mentioned, in the preceding article, the principles on which the ſugar-mill is conſtructed: but in order to convey a more adequate idea of theſe machines, we have given perſpective views of two on plate CXXIV. one turned by horſes, the other by water.

Fig. 1. is a ſugar-mill worked by horſes, or other animals. A, A, the frame of wood made very ſtrong. B, B, the baſon of the mill, made out of a large block of wood, the upper ſurface of which is hollowed, and lined with lead. C, C, C, three rollers, revolving on an iron axis, their lower and upper extremities being formed into pivots, which move in gugeons. D, D, D, D, apertures for changing, or repairing the pivots or gugeons. E, E, two large apertures, for locking or faſtening the wedges which ſupport the pivots, and conſequently keep the rollers in their proper poſition. F, F, apertures of the ſame kind, for faſtening the wedges of the upper pivots. G, G, toothed wheels fixed to the upper ends of the rollers, by which they are turned contrary ways. H, the axis, or arbor of the middle roller extended. I, the collar, in which the point of that extended axis turns. K, K, arms of the mill, by which the moving force is applied. L, L, pieces of timber, for ſupporting the collar. M, a pipe, or gutter, for conveying the juice preſſed out of the cane by the mill to the boiling houſe.

Fig. 2. A ſugar-mill turned by a fall of water. A, A, the frame of the mill, made very ſtrong. B, the baſon of the mill lined with lead for receiving the juice of the ſugar-canes, as in the preceding figure. C, C, C, the three rollers, deſcribed in the firſt figure. D, the vertical arbor of the middle roller, which is turned by a cog-wheel F; its pivot moving in a gugeon ſupported by the pieces E, E. F, the cog-wheel, which turns the middle roller, and conſequently the other two rollers the contrary way. G, another cog-wheel which acts as a lantern, and moves the cog-wheel F. H, the axis or ſhaft of the great-wheel. I, the buckets of the large wheel, filled by the fall of water from the trough K. L, a ſmall gutter of wood, which carries the juice of the ſugar from the mill to the boiling-houſe. M, the negro who puts the ſugar canes into the mill. N, the ſugar canes. O, a pully for raiſing the arbor, when the lower pivots, &c. want repairing.

SUGAR-CANDY, *Saccharum Candum*, or *Cryſtallinum*, is ſugar depurated and cryſtalliſed.

This is better made of earthed ſugar, than refined ſugar, in regard the former is ſweeter.

The ſugar to be uſed herein is firſt diſſolved in a weak lime-water, then clarified, ſcummed, ſtrained through a cloth, and boiled, and put in forms or moulds that are traverſed with little rods, to retain the ſugar, as it cryſtalliſes. Theſe forms are ſuſpended in a hot ſtove, with a pot underneath, to receive the ſyrup that drops out at the hole in the bottom, which is half ſtopped, that the filtration may be the gentler. When the forms are full, the ſtove is ſhut up, and the fire made very vehement.

Upon this the ſugar faſtens to the ſticks that croſs the forms, and there hangs in little ſplinters of cryſtal. When the ſugar is quite dry, the forms are broke and the ſugar taken out, candied. Red ſugar-candy they make, by caſting into the veſſel, where the ſugar is boiling, a little juice of the Indian fig; and, if it is deſired to have it perfumed, they caſt a drop of ſome eſſence in, when the ſugar is putting into the forms.

This method of making ſugar-candy is that of F. Labat, practiſed in the Caribbees: the method in Europe, deſcribed by Pomet, is ſomewhat different.

White SUGAR-CANDY, they make of white refined ſugar, boiled with water into a thick ſyrup, in a large pan. It is candied in a ſtove, whither it is carried, incloſed in braſs peels, croſſed with little rods, about which the cryſtals faſten, as they are formed.

The fire of the ſtove is kept equable for fifteen days; after which the ſugar is taken out of the peels to be dried. Red or brown ſugar-candy is made like the white, except that they only uſe brown ſugars and earthen pots.

Barley SUGAR, *Saccharum Hordeatum*, is a ſugar boiled till it be brittle, and then caſt on a ſtone anointed with oil of ſweet almonds, and formed into twiſted ſticks, about the length of the hand, and the thickneſs of a finger.

It ſhould be boiled up with a decoction of barley, whence it takes its name; but in lieu thereof they now generally uſe common water, to make the ſugar the finer. —To give it the brighter amber colour, they ſometimes caſt ſaffron into it. — It is found very good for the cure of colds and rheums.

SUGAR-SPIRIT, a name given by our diſtillers to a ſpirit made in England, Holland, and other places, from the waſhings, ſcummings, droſs, and waſte of a ſugar-baker's refining-houſe. The manner of preparing it is the ſame with that uſed for the malt and melaſſes ſpirits. The refuſe of the ſugar is fermented with water in the uſual manner, then diſtilled into what is called low wines, and afterwards rectified, without an addition, into proof ſpirit.

When the operation is well performed, and no foul, fœtid, or foreign matter, has got in among the waſh, this is a tolerably clean ſpirit. We uſually make it ſuch, but in Holland it is uſually made very nauſeous and diſagreeable; though capable, by an eaſy rectification familiar with us, though not much known abroad, of being brought to a fine and clean ſpirit. With us this ſugar-ſpirit is uſed to mix with and adulterate brandy, rum, and arrac, which will receive a large doſe of it without its being at all diſcoverable; but the Dutch who have it very coarſe, can only adulterate rum with it, and even that will bear but a ſmall proportion, without being betrayed by its nauſeouſneſs.

This ſugar ſpirit reduced to alcohol makes one of the pureſt ſpirits we are acquainted with, much ſuperior to that of melaſſes, and much more to that of malt. *Shaw's Eſſay on Diſt.*

SUGILLATION, in medicine, an extravaſation of blood in the coats of the eye, which at firſt appears of a reddiſh colour, and afterwards livid or black. If the diſorder is great, bleeding and purging are proper, as are diſcutients. The following cataplaſm is ſaid to be very good: Take of comfry-root, ſix ounces; of Solomon's ſeal, two ounces; of elder-flowers, one ounce and a half; of bean-flour, one ounce; let all theſe be boiled in a ſufficient quantity of ſpring-water. The decoction may be uſed as a fotus, and the ingredients for a cataplaſm.

SUIT, in law, is uſed in different ſenſes; as, 1. For an action, whether perſonal or real. 2. Suit of court, or ſuit-ſervice, which is an attendance the tenant owes to his lord's court. 3. Suit covenant, where a perſon has covenanted to do ſervice in the court of the lord. 4. Suit cuſtom, which is where one and his anceſtors have owed ſuit time out of mind. 5 It is uſed for a petition to the king, or any perſon of dignity: where a lord diſtrains his tenant for ſuit, and none is due; in this caſe, the party may have an attachment againſt him to appear in the king's court. 6. Suit of the king's

peace, is an action brought againſt a perſon for breach of the king's peace; as in the caſe of treaſons, felonies, or treſpaſſes.

SULPHUR, in natural hiſtory, a mineral ſubſtance, fuſible and inflammable by fire, and not diſſoluble or miſcible in water. The name ſulphur has been applied by ſome to the inflammable principle of bodies; by others, to all inflammable mixts, or ſubſtances participating of this principle; and the alchemiſts ſpeak alſo of a ſulphur that does not burn. Vegetable oils and reſins, animal fats, mineral bitumens, are by ſome called ſulphurs; and by ſome ſulphur itſelf is referred to the bitumens. This confuſion has given riſe to numerous errors and abſurdities: how widely different is true ſulphur, in all its properties, from bitumens, or oils, or any other kind of inflammable body! If every thing that burns was to be called ſulphur, we might with equal propriety call every thing that is liquid by the name of water, or of ſpirit of wine, or vinegar, or oil, or any other particular liquor. Experiment has fully evinced, that ſulphur is no other than the concentrated vitriolic acid combined with a ſmall proportion of the phlogiſtic or inflammable principle; and to this combination alone, which is always one and the ſame, excepting for adventitious admixtures, the more judicious chemiſts have wholly confined the name.

Sulphur is a ſolid brittle concrete, of a yellow colour inclining a little to greeniſh, in ſome degree gloſſy. Held in the warm hand, it crackles, or burſts: and leaves on the hand a particular kind of ſmell. It is nearly twice as heavy as an equal bulk of water.

It melts in a ſmall degree of heat into a red pellucid fluid, and on cooling concretes again into its original appearance. Some have endeavoured to purify ſulphur from the droſſy matters which are often mixed with it, by melting and pouring it into ſpirit of wine: others have melted it with wax, and poured the fluid mixture into water when the ſulphur ſubſides, and the wax ariſes to the ſurface, carrying up with it a part of the impurities. With regard to ſpirit of wine, it can have no effect in ſeparating foreign matters from the ſulphur, though it ſeems in ſome meaſure to heighten the yellow colour. Wax on the other hand renders it greener, and if the fuſion is ſeveral times repeated, changes it quite blackiſh.

Sulphur kept in fuſion, gradually exhales: if the air is excluded, it ſublimes into the upper part of the veſſel, without undergoing any other alteration, than being reduced into the form of powder or flowers. This property affords a method of purifying it effectually from earthy, ſtony, or other fixed matters; and at the ſame time of reducing it into a finer powder than can eaſily be obtained by trituration. Where only a ſmall quantity of flowers of ſulphur is wanted, the ſublimation may be performed in a jar, with aludels cloſely luted upon it, and a blind-head at top. In England, they are prepared by particular perſons in the way of trade: the ſubliming veſſel is an iron pot, ſo large as to hold two or three hundred weight or more of ſulphur, about a fourth of its capacity remaining empty: the recipient is an arched room built above the pot, and communicating with it at one ſide by an aperture of ſix or eight or more inches in diameter. The room is lined with glazed tiles; and furniſhed with a door, by which a man may creep in, when the operation is finiſhed, to ſweep out the flowers. In the middle of the door is a ſmall hole, which is opened occaſionally during the ſublimation, for examining whether the flowers continue or have ceaſed to ariſe.

In open veſſels, ſulphur readily takes fire from the contact of ignited bodies, and if kept in fuſion, burns entirely away, with a blue flame, and a diffuſive ſuffocating fume. This fume is no other than the vitriolic acid volatilized by the flame: a conſiderable quantity of it may be detained, and condenſed into a liquid form, by placing over the burning ſulphur capacious glaſs veſſels, replete with aqueous vapours: the larger the receivers, and the leſs communication the flame has with the external air, the more of the fumes will be preſerved.

The common apparatus for this purpoſe conſiſts of a little earthen diſh, for burning the ſulphur in; a glaſs bell, ſuſpended over the flame; and a broad glaſs or earthen veſſel, which ſupports the diſh with the ſulphur, and receives the acid liquor as it drops from the ſides of the bell. Many variations have been made in this apparatus, with a view to detain the fumes more effectually. Inſtead of the bell, from which the acid has received the name of ſpiritus ſulphuris per campanam, ſome have employed a glaſs differing from that ſhape in having a rim turned in at the bottom, and a tube at the top, to which a receiver is fitted as an enlargement of the capacity of the veſſel; others a retort, with its bottom cut out, and a glaſs body or tubulated receiver applied to its neck; others a receiver, with a hole in its bottom for admitting the flame; others a glaſs body, with ſome water in its bottom, holes in the ſides, a crucible with burning ſulphur placed in the water, and another body inverted on the mouth: ſome have ſuſpended the burning ſulphur in a wooden caſk half full of water, and afterwards rectified the liquor. The grand difficulty is, that ſulphur will not burn without a draught of air, and the acid fumes are ſo volatile that far the greateſt part of them is carried off by the air. Some direct a little nitre to be mixed with the ſulphur, to promote its burning; but though nitre is undoubtedly of advantage in that reſpect, it is injurious in another; rendering the product impure, by giving out its own acid along with that of the ſulphur. Many other contrivances have been made, but none with any commendable ſucceſs; the ſame acid being obtainable at a much eaſier rate from vitriol, than by any methods of procedure to which ſulphur has hitherto been ſubmitted. The beſt way hitherto diſcovered of collecting the acid ſpirit of ſulphur in a volatile ſtate, is that given by Stahl: the ſulphur is made to burn ſlowly by means of a wick, a number of aludels ſet over it, and a cloth moiſtened with ſtrong alcaline ley placed in each aludel: as ſoon as any of the cloths become dry, a moiſt one is put in its room. The alcaline ſalt which the cloths were impregnated with, imbibes the acid fumes, and is thus converted into a neutral ſalt, which is eaſily rubbed out. It is the volatile vitriolic acid that this ſalt contains; and hence, upon adding to it common oil of vitriol, in a tubulated retort, the volatile ſpirit diſtils, leaving the alcali combined with the more powerful fixed acid ſuperadded. The volatile however, as well as the fixed acid is ſtill more commodiouſly and advantageouſly obtainable from vitriol itſelf.

It was formerly ſuppoſed, that the acid ſpirits of vitriol and ſulphur were really different from one another, and hence they were received in the ſhops as two diſtinct acids: their identity is evident from hence; that the ſpirit obtained from common ſulphur, united with metals, forms a true vitriol: and the ſpirit extracted from common vitriol forms, with inflammable ſubſtances, a perfect ſulphur, not diſtinguiſhable on any trial from pure mineral brimſtone.

Sulphur does not diſſolve in water, in ſpirit of wine, or in acid liquors: the vitriolic acid, nevertheleſs, extracts a part of the acid of the ſulphur, ſo as to gain a conſiderable increaſe of its own acidity. Fixed alcaline ſalts, injected upon half their weight or leſs of melted ſulphur, readily unite with it into a red or liver coloured maſs, called hepar ſulphuris, which deliquiates in the air, diſſolves in water, and gives a golden tincture to ſpirit of wine: the watery ſolution, kept for ſome time, generally depoſits a black powder: ſulphur is diſſolved alſo by boiling in fixed alcaline lixivia, or in lime water. The addition of any acid to theſe ſolutions, renders them milky, and precipitates the ſulphur in form of a white powder called lac ſulphuris: during the precipitation, an extremely fetid vapour ariſes, which blackens metalline utenſils, particularly ſilver ones, at a conſiderable diſtance.

If the mixture of ſulphur and fixed alcaline ſalt be reduced to powder, kept for ſome time in a gentle heat, and frequently ſtirred; the ſulphur will be deſtroyed, or reſolved into its conſtituent parts. The inflammable principle is gradually diſſipated, and only the acid of the ſulphur remains combined with the alcali. Inſtead of a red, fetid, alcaline, ſulphureous compound, we find now a white, inodorous, neutral ſalt, the ſame as if common oil of vitriol had been mixed with the alcali:

From

From this experiment we are enabled to determine the proportions of acid and phlogiſton of which ſulphur conſiſts; the increaſe of weight which the alcaline ſalt acquires being pure concentrated acid. It appears upon careful trial, that in ſixteen ounces of ſulphur, there are upwards of fifteen ounces and ſix drams of pure vitriolic acid void of phlegm; the inflammable matter, by which ſo large a quantity of that moſt corroſive acid is in all its properties ſo ſurpriſingly changed, amounting only to about a dram.

Some report that ſulphur will diſſolve in volatile alcaline ſpirits, without any intermedium. Boerhaave directs, for this purpoſe, any ſtrong alcaline ſpirit to be diſtilled from flowers of ſulphur, and cohobated or drawn over a ſecond time from the reſiduum; or the mixture to be long kept in a cloſe veſſel, and frequently ſhaken. I tried ſtrong ſpirits of ſal ammoniac, both ſimple and dulcified, prepared both with alcaline ſalt and with quick-lime, and a ſpirit ſaturated with oil of aniſeeds: but none of the five made any ſolution, or extracted any tincture from the ſulphur, either by digeſtion or diſtillation.

There are means, however, of procuring a perfect ſolution of ſulphur in volatile ſpirits; namely, by mixing the ſulphur, not with the ſpirit already prepared, but with crude ſal ammoniac; and adding quick-lime to extricate the volatile alcali, which thus will elevate with it in diſtillation a conſiderable portion of the ſulphur. Beguinus takes four parts of ſulphur, two of quick-lime, and one of ſal-ammoniac. — Hoffmann's proportions, three parts of lime, two of ſal ammoniac, and three of ſulphur, ſucceeded better with me. The mixture is to be put into a retort, and diſtilled by a gradual fire, the juncture of the retort with the receiver being cloſely luted. The diſtilled liquor called ſulphureous ſpirit of ſal ammoniac, ſmoking ſpirit of ſulphur, or volatile tincture of ſulphur, is extremely volatile and penetrating, emits highly fetid vapours, which blacken ſilver, and give colour to inviſible writings made with ſaturnine ſolutions, like the liquor of orpiment. It is employed medicinally in ſome compoſitions; internally as a ſudorific, and externally as an antipodagric.

Sulphur diſſolves in oils, by the aſſiſtance of a boiling heat, into a thick, yellowiſh or reddiſh fluid, called balſam or oily liver of ſulphur. This proceſs ſhould be performed without doors, in large veſſels; the matter conſtantly watched and ſtirred, and, if it begins to riſe up, removed immediately from the fire: otherwiſe the combuſtible compound will ſuddenly run over into the furnace, and may be productive of terrible conſequences.

Expreſſed oils diſſolve ſulphur far more readily and plentifully than the diſtilled. The balſams of ſulphur with diſtilled oils, directed in books of pharmacy, are very injudicious preparations; as the oil will ſcarcely gain any tincture from the ſulphur, without a boiling heat; and ſuch a heat will deſtroy the flavour and peculiar qualities of the oil. If theſe kinds of preparations are wanted, they may be much more commodiouſly and advantageouſly obtained by adding a due proportion of any eſſential oil to the ſolution made with expreſſed ones. Expreſſed oils will eaſily take up half their weight of ſulphur, and form with it, when grown cold, a thick conſiſtent maſs: if this be liquified by a gentle heat, and any eſſential oil added, they will readily incorporate together. The eſſential oil of anniſeed differs remarkably from all the other diſtilled oils, in its power of diſſolving ſulphur; taking up rather more even than the expreſſed. This oil, digeſted with the hepar ſulphuris, or compoſitions of ſulphur and fixed alcaline ſalts, readily takes up a large quantity of ſulphur from the alcali: other eſſential oils abſorb very little; and expreſſed ones ſcarce any at all. It is obſervable that the balſam of ſulphur with oil of turpentine, if ſaturated with the ſulphur whilſt hot, concretes on cooling into a curious vegetation reſembling a tree.

Sulphur unites in the fire with moſt metallic bodies, promotes the fuſion of the refractory ones iron and copper, renders lead on the other hand almoſt unfuſible, and debaſes the quality of them all. It changes ſeveral into the appearance of their own ores; ſilver, into a ſoft leaden coloured ſubſtance, reſembling the malleable ſilver ore; iron and copper into yellowiſh concretes, like the natural pyritæ; the antimonial regulus into antimony; quickſilver and arſenics into red compounds, the ſame with the native cinnabar and red arſenic; lead, into a dark-coloured maſs, like its common ore; tin into a ſubſtance like antimony, a form in which that metal is never found in the earth. Pure ſulphur does not act upon gold, but ſulphurated alcali or hepar ſulphuris unites with gold in fuſion as well as with other metals, and renders it diſſoluble in water ſo as to paſs through the pores of a filter. The principal uſe of ſulphur is in fire-works, and for making gunpowder. It is likewiſe employed in ſome woollen manufactures, in bleaching, for making cinnabar, by the wine-coopers, for ſundry œconomical and other like purpoſes.—It is uſed medicinally againſt cutaneous eruptions, and diſorders of the lungs: from the virtues attributed to it in this laſt intention, it has received the name of anima pulmonum.

Sulphur is ſometimes found native in the earth, in pure, bright yellow, ſemitranſparent maſſes; but more commonly in opake ones, of a greeniſh, greyiſh, and other colours, intermixed with various earthy or ſtony matters: theſe impure ſorts are thoſe commonly underſtood by the name of ſulphur vivum. The native ſulphurs are met with chiefly about volcanos in Italy, in ſome of the German, Hungarian, and Swediſh mines. A pale yellow tranſparent ſulphur is brought from Guadaloupe in America; and Monardus mentions a ſulphur as tranſparent as glaſs, and in colour like gold.

There are likewiſe reddiſh, and red ſulphurs; of which I have ſeen ſome of a ſemitranſparent cinnabarine red: theſe are never to be employed for medicinal uſe, as they are rarely free from an admixture of arſenic, and indeed are rather to be looked upon as a native red arſenic or realgar, than as ſulphurs: the redder the colour, the more arſenic they generally hold. The greateſt quantities of theſe red arſenical ſulphurs are found in the Turkiſh dominions; and ſome in the territories of Saltzburg.

Authors mention another ſort of native ſulphur, which ſeparates from the hot mineral waters, particularly thoſe of Aix-la-chapelle: whether this yellow ſediment be a true ſulphur or not, I cannot determine, as I have not had an opportunity of examining it.

Sulphur is an ingredient in moſt kinds of ores, and frequently is the only one by which metallic bodies are debaſed in the earth into that form. Tin, biſmuth, and cobalt are the only ones which have no ſulphur in their ores: arſenic and gold are frequently accompanied with it: ſilver, a good deal more frequently, and lead ſtill more ſo: of copper, it is a more conſtant attendant than of any of the foregoing: mercury and regulus of antimony are never found without it. The common ores of iron rarely hold any ſulphur: the mineral, however, which contains the largeſt quantity of ſulphur, or from which the ſulphur is extracted to the greateſt advantage, is a ferrugineous ore, called, from its colour, and from its ſtriking fire with ſteel, yellow pyrites.

The yellow pyritæ are found moſt plentifully in ſome parts of Sweden, and in Saxony, where the principal ſulphur works are eſtabliſhed. The ſulphur is extracted in ſome places, by diſtillation in large iron retorts: in others, by eliquation in earthen veſſels; the ſulphur, as it melts out from the ore, being conveyed along inclined pipes into veſſels of cold water. At Goſlar, in the Lower Saxony, great quantities of ſulphur are collected in the calcination of certain ores in the open air: the ore being ſtratified with wood, and the wood ſet on fire, the ſulphur melts out in different parts of the pile, and is received in veſſels placed underneath, or on cavities made for that purpoſe in the matter itſelf when ſoftened by the heat: the rough ſulphur obtained by theſe proceſſes is purified by fuſion; which is ſometimes twice or thrice repeated: the lighter feculencies, which ariſe to the ſurface, are ſkimmed off; and the fluid ſulphur poured from the groſſer ſediment that falls to the bottom. Moſt of the ſulphur prepared in Germany appears of a fine yellow colour, or inclines but a little to greeniſh yellow; the Swediſh, particularly that which comes from the iſland Melo, has more of the green, and is not near ſo fine. The impure ſulphur, or dregs remaining after

the purification, are called ſulphur caballinum, as being only fit for horſes; but even for ſuch purpoſes, it is ſurely more adviſable to uſe pure ſulphur, than an unequal and an unknown mineral medley, which may often do more harm than good.

Hoffman and others have preſumed, that ſulphur exiſts in the air, and that from this proceed thunder, lightning, and other fiery meteors; the vitriolic acid and inflammable principle, the very ingredients from which art produces ſulphur, being unqueſtionably diffuſed through the atmoſphere. Plauſible as this theory may appear, it is liable to conſiderable objections: art cannot produce ſulphur without a degree of fire, which we cannot ſuppoſe to have any place in the atmoſphere: no ſulphur can be generated but with the concentrated acid, and how infinitely, on the other hand, is the aereal acid divided and diluted! Beſides, the effects of ſulphur and of lightning are in no wiſe ſimilar. *Neumann's Chemiſtry.*

SUM, *Summa*, in arithmetic, &c. ſignifies the quantity that ariſes from the addition of two or more magnitudes, numbers, or quantities together.

The ſum of an equation is, when the abſolute number being brought over to the other ſide with a contrary ſign, the whole becomes equal to 0: this Des Cartes calls the ſum of the equation propoſed.

SUMACH, *Rhus*, in botany, a low tree, or ſhrub, with oval, pointed, ſerrated, downy leaves, having each a red rib running along the middle, ſet in pairs without pedicles, producing cluſters of ſmall yellowiſh or greeniſh flowers, each of which is followed by a ſmall, red, flattiſh berry, including a roundiſh reddiſh-brown ſeed. It is a native of the ſouthern parts of Europe, and cultivated in ſome of our gardens.

The berries of ſumach have an acid auſtere taſte: they were formerly uſed for reſtraining bilious fluxes, and hemorrhages, and colliquative hectic ſweats: ſome direct an infuſion of half an ounce of the berries, and others two or three drams of an extract made from them by water, for a doſe. The leaves and young twigs are ſtrong aſtringents, and have been directed in the ſame intentions.

SUMMARY, in matters of literature, the ſame with abridgment.

Summary, however, is often uſed for a table of contents, placed at the beginning of books, to ſhew the principal heads treated of therein.

SUMMER, one of the ſeaſons of the year, commencing in theſe northern regions on the day the ſun enters Cancer, and ending when he quits Virgo. Or, more ſtrictly and univerſally, the ſummer begins on the day when the ſun's meridian diſtance from the zenith is the leaſt; and ends on the day, when his diſtance is a mean betwixt the greateſt and ſmalleſt. The end of ſummer coincides with the beginning of winter.

SUMMER, in architecture, is a large ſtone, the firſt that is laid over columns and pilaſters, in beginning to make a croſs vault; or it is the ſtone which, being laid over a piedroit or column, is hollowed to receive the firſt haunce of a platband.

SUMMER, in carpentry, is a large piece of timber which being ſupported on two ſtone piers or poſts, ſerves as a lintel to a door, window, &c.

SUN, *Sol*, in aſtronomy, the great luminary which enlightens the world, and, by his preſence, conſtitutes day.

Sir Iſaac Newton, in his Principia, proves that the matter of the ſun to that of Jupiter is nearly as 1100 to 1; and that the diſtance of that planet from the ſun is in the ſame ratio to the ſun's ſemidiameter.

That the matter of the ſun to that of Saturn is as 2360 to 1; and the diſtance of Saturn from the ſun is in a ratio but a little leſs than that to the ſun's ſemidiameter.

And conſequently that the common center of gravity, of the ſun and Jupiter, is nearly in the ſuperficies of the ſun; of Saturn and the ſun, a little within it. And by the ſame manner of calculation it will be found that the common center of gravity of all the planets cannot be more than the length of the ſolar diameter diſtant from the center of the ſun. This common center of gravity he proves to be at reſt; and therefore, though the ſun, by reaſon of the various poſition of the planets, may be moved every way, yet it cannot recede far from the common center of gravity. And this he thinks ought to be accounted the center of our world. *Book* 3. *prop.* 12.

By means of the ſolar ſpots it hath been diſcovered, that the ſun revolves round his own axis, without moving (conſiderably) out of his place, in about twenty-five days. And that the axis of this motion is inclined to the ecliptic, in an angle of 87 degrees, 30 min. nearly. *Gregor. Aſtron.*

The ſun's apparent diameter being ſenſibly ſhorter in December than in June, as is plain and agreed from obſervation, the ſun muſt be proportionably nearer to the earth in winter than in ſummer; in the former of which ſeaſons will be the perihelion, in the latter the aphelion: And this is alſo confirmed by the earth's moving ſwifter in December than it doth in June. For ſince, as Sir Iſaac Newton hath demonſtrated by a line drawn to the ſun, the earth always deſcribes equal areas in equal times, whenever it moves ſwifter, it muſt needs be nearer to the ſun. And for this reaſon there are about eight days more from the ſun's vernal equinox to the autumnal, than from the autumnal to the vernal.

According to Mr. Caſſini, the ſun's greateſt diſtance from the earth is 22374, his mean diſtance 2200, and his leaſt diſtance 8022 ſemidiameters of the earth.

And that the ſun's diameter is equal to 100 diameters of the earth, and therefore the body of the ſun muſt be 1000000 times greater than that of the earth.

Mr. Azout aſſures us, that he obſerved by a very exact method the ſun's diameter to be not leſs than 31 minutes 45 ſeconds, in his apogee, and not greater than 32 minutes 45 ſeconds, in his perigee.

The mean apparent diameter of the ſun, according to Sir Iſaac Newton, is 32 minutes 12 ſeconds; in his theory of the moon, 32 minutes 15 ſeconds.

If you divide 360 degrees (i. e. the whole ecliptic) by the quantity of the ſolar year, it will quote 59 minutes 8 ſeconds, &c. which therefore is the quantity of the ſun's diurnal motion. And, if this 59 minutes 8 ſeconds be divided by 24, you have the ſun's horary motion, which is 2 minutes 28 ſeconds; and, if you will divide this laſt by 60, you will have this motion in a minute, &c. And this way are the tables of the ſun's mean motion, which you have in the books of aſtronomical calculation, conſtructed.

The ſun's horizontal parallax Dr. Gregory and Sir Iſaac Newton make but 10 ſeconds.

To find this angle, aſtronomers have attempted variety of methods, but have as yet found none that will determine it exactly; however, by many repeated obſervations of Dr. Halley, it is found to be not greater than 12″, nor leſs than 9″. Wherefore 10 $\frac{1}{2}$″ (the mean) has been fixed upon as near the truth. By a tranſit of Venus over the ſun's diſk, the ſame gentleman has ſhewn how the ſun's parallax may be determined to a great nicety, viz. to within a 500dth part of the whole. See Phil. Tranſ. N°. 348, abridged by Jones, Vol IV.

Sir Iſaac Newton, in his Optics, gives good reaſons to ſuppoſe the ſun and fixed ſtars to be great earths vehemently hot; whoſe heat is conſerved by the greatneſs of their bodies, and the mutual action and re-action between them and the light which they emit; and whoſe parts are kept from fuming away, not only by their fixity, but alſo by the vaſt weight and denſity of the atmoſpheres incumbent on them, and every way ſtrongly compreſſing them, and condenſing the vapours and exhalations which ariſe from them. The light ſeems to be emitted from the ſun and fixed ſtars (which probably are ſuns to other ſyſtems) much after the manner as iron, when heated to ſuch a degree as to be juſt going into fuſion by the vibrating motion of its parts, emits, with force and violence, copious ſtreams of liquid fire all around. Great bodies muſt preſerve their heat longeſt, and that, perhaps, in the proportion of their diameters.

Sir Iſaac Newton hath made it probable, that the great comet in the year 1680, in its perihelion, would not entirely go off in 50000 years. Whence we may conjec-

ure that if the ſun and fixed ſtars be only collections of denſe and ſolid matter, like the planets, but heated to a very intenſe degree, they may be many millions of years without loſing any conſiderable part of their heat.

SUN-FLOWER, in botany, a genus of plants, the flower of which is of a radiated kind; its diſk is made up of floſcules, and its outer edge of ſemifloſcules; theſe ſtand upon the embryo ſeeds, and are ſeparated from one another by little leaves of an imbricated figure, and contained in a ſcaly huſk, or cup; the embryo's finally ripen into ſeeds furniſhed with two little leaves. See HELIANTHUS, and HELIANTHEMUM.

There are ſeveral different ſpecies of this flower, all which are very beautiful in large gardens. They are moſt of them annual plants, and are to be ſown every ſpring in a bed of good light earth. When the ſhoots are about three inches high, they muſt be tranſplanted into nurſery beds, and ſet at eight inches diſtant every way; they ſhould remain there till they are a foot high, and then be carefully taken up with a ball of earth at their roots, and planted in large borders, or intermixed in the boſquets of large growing plants; they muſt be frequently watered till they have taken root, and after that will require no farther care. In July the flowers appear, and ſtand a conſiderable time: the largeſt of theſe ſhould be left to ſtand for ſeed. The birds are very apt to devour this ſeed, but it ſhould be carefully guarded from them, and the head left on the plant till October, at which time it ſhould be cut off, and hung up to dry in an airy place, and in a month more the ſeeds will be perfectly hardened.

Several ſpecies of this plant alſo are perennial, and increaſe greatly by the root. Among theſe the common ſmaller flowered one is a very valuable plant in gardens, as it requires no culture, will grow in all ſoils and ſituations, and is a very ornamental flower, continuing in bloom from June to October.

SUN-SCORCHED, a term uſed by our gardeners in ſome parts of England to expreſs a diſtemperature of fruit trees, owing to the ſun's affecting them forcibly and too ſuddenly; the conſequence of which is the loſs and withering of the fruit. Such trees only are ſubject to this, as are planted in places ſheltered from the ſpring ſun, and only open to the ſummer's; and it may be always cured by proper waterings.

SUNDAY, or the LORD'S-DAY, a ſolemn feſtival obſerved by Chriſtians on the firſt day of every week, in memory of our Saviour's reſurrection.

This is the principal and moſt noted of the chriſtian feſtivals, and was obſerved with great veneration in the ancient church, from the time of the apoſtles, who themſelves are often ſaid to have met on that day for divine ſervice. It is likewiſe called the ſabbath-day, as being ſubſtituted in the room of the Jewiſh ſabbath.

The ancients retained the name Sunday, or *dies ſolis*, in compliance with the ordinary forms of ſpeech, the firſt day of the week being ſo called by the Romans, becauſe it was dedicated to the worſhip of the ſun.

Beſides that the moſt ſolemn parts of the Chriſtian worſhip were always performed on Sundays, this day was diſtinguiſhed by a peculiar reverence and reſpect expreſſed towards it in the obſervation of ſome ſpecial laws and cuſtoms. Among theſe, we may reckon in the firſt place, thoſe imperial laws which ſuſpended all proceedings at law upon this day, excepting only ſuch as were of abſolute neceſſity, or eminent charity; ſuch as the manumiſſion of ſlaves, and the like. Neither was it only the buſineſs of the law, but all ſecular and ſervile employments were ſuperſeded upon this day, ſtill excepting acts of neceſſity and mercy. Another thing which the chriſtian laws took care of, to ſecure the honour and dignity of the Lord's day, was, that no ludicrous ſports or games ſhould be followed on this day; but all ſuch recreations and refreſhments as tended to the preſervation or conveniency of life were allowed of; and therefore, Sunday was always a day of feaſting, and it was not allowable to faſt thereon, not even in Lent. The great care and concern of the primitive chriſtians in the religious obſervation of the Lord's-day, appears firſt from their conſtant attendance upon all the ſolemnities of public worſhip, from which nothing but ſickneſs, impriſonment, baniſhment, or ſome great neceſſity could detain them. Secondly, from their zeal in frequenting religious aſſemblies on this day, even in times of the hotteſt perſecution, when they were often beſet and ſeized in their meetings and congregations. Thirdly, from their ſtudious obſervations of their vigils or nocturnal aſſemblies that preceded the Lord's-day. Fourthly, from their eager attendance on ſermons, in many places twice upon this day, and their conſtant reſorting to evening prayers, where there was no ſermon. Laſtly, from the ſevere cenſures inflicted on thoſe who violated the laws concerning the religious obſervation of this day, ſuch perſons being uſually puniſhed with excommunication, as appears from the apoſtolical conſtitutions, and the canons of ſeveral councils. In the Romiſh breviary, and other offices, we meet with a diſtinction of Sundays, into thoſe of the firſt and ſecond claſs; Sundays of the firſt claſs are, Palm-ſunday, Eaſter-ſunday, Advent, Whit-ſunday, &c. thoſe of the ſecond claſs are the common Sundays of the year.

By our laws, no perſon is to do any worldly labour on this day, which is ſet apart for the ſervice and worſhip of God, except works of neceſſity and charity, under the penalty of five ſhillings. And if any perſon cry, or expoſe to ſale any wares, or goods on a Sunday, the ſame will be forfeited to the poor, &c. the offender being convicted thereof before a juſtice of the peace, &c. who is authorized to cauſe the penalties and forfeitures to be levied by diſtreſs. Yet this extends not to dreſſing of meat, nor to the ſelling of milk in the morning or evening, or the ſelling of mackrel on that day. The Sunday is not a day in law, ſo that no proceſs lies, or may be ſerved thereon, except for treaſon, or felony, or an eſcape. A ſale of goods, or contract made on a Sunday, is deemed void.

SUNDAY *Letter*. See DOMINICAL LETTER.

SUOVETAURILIA, an ancient Roman ſacrifice, ſo called becauſe it conſiſted of a pig, *ſus*, a ſheep, or rather ram, *ovis*, and a bull, *taurus*. They were all males to denote the maſculine courage of the Roman people. It was likewiſe called ſolitaurilia, becauſe the animals offered up were always, *ſolida*, whole or uncut.

SUPERCARGO, a perſon employed by merchants to go a voyage, and overſee their cargo, or lading, and diſpoſe of it to the beſt advantage.

SUPERCILIUM, in anatomy, the hairy arch extended over the orbit of each eye.

SUPERCILIUM, in the ancient architecture, the uppermoſt member of the corniche, called by the moderns corona, crown, or larmier.

It is alſo uſed for a ſquare member, under the upper tore in ſome pedeſtals; ſome authors confound it with the tore itſelf.

SUPEREROGATION, in theology, what a man does beyond his duty, or more than he was commanded to do. The Romaniſts ſtand up ſtrenuouſly for works of ſupererogation, and maintain, that the obſervance of evangelical councils is ſuch. By means of which, a ſtock of merit is laid up, which the church has the diſpoſal of, and which ſhe diſtributes in indulgences to ſuch as need. The reformed church do not allow of any work of ſupererogation.

SUPERFETATION, *Superfœtatio*, in medicine, a ſecond, or after conception, happening, when the mother, already pregnant, conceives of a later coition; ſo that ſhe bears at once two fœtuſes of unequal age and bulk, and is delivered of them at different times. We meet with inſtances of ſuperfœtations in Hippocrates, Ariſtotle, Du Laurens, &c. But they are ſaid to be much more frequent in hares and ſows. Naturaliſts hold that female rats are frequently born with young rats in their wombs; and we are told of extraordinary inſtances of this kind in the female part of the human ſpecies, by Bartholine, Mentzelius, and in the Hiſtory of the Royal Academy of Sciences.

SUPERFICIES, or SURFACE, in geometry, a magnitude conſidered as having two dimenſions; or extended in length and breadth, but without thickneſs or depth. In bodies, the ſuperficies is all that preſents itſelf to the eye. A ſuperficies is chiefly conſidered as the external part of a ſolid. When we ſpeak of a ſurface ſimply,

ſimply, and without any regard to body, we uſually call it figure. The ſeveral kinds of ſuperficies are as follows. Rectilinear ſuperficies, that comprehended between right lines; curvilinear ſuperficies, that comprehended between curve lines; plane ſuperficies, is that which has no inequality, but lies evenly between its boundary lines; convex ſuperficies, is the exterior part of a ſpherical, or ſpheroidical body; and a concave ſuperficies, is the internal part of an orbicular or ſpheroidical body.

The meaſure or quantity of a ſuperficies, or ſurface, is called the area thereof.

The finding of this meaſure, or area, is called the quadrature thereof.

To meaſure the ſurfaces of the ſeveral kinds of bodies, as ſpheres, cubes, parallelopipeds, pyramids, priſms, cones, &c. ſee SPHERE, &c.

Line of SUPERFICIES, a line uſually found on the ſector, and Gunter's ſcale, the deſcription and uſe whereof, ſee under the article SECTOR and GUNTER'S SCALE.

SUPERFINE, in the manufactories, a term uſed to expreſs the ſuperlative fineneſs of a ſtuff; thus a cloth, a camblet, &c. are ſaid to be ſuperfine, when made of the fineſt wool, &c. or when they are the fineſt that can be made. The term is particularly uſed among gold or ſilver wire-drawers, for the gold or ſilver wire, which after being drawn through an infinite number of holes, each leſs and leſs, is at length brought to be no bigger than an hair.

SUPERINSTITUTION, *Superinſtitutio*, denotes an inſtitution upon another, as where A B is admitted and inſtituted to a benefice upon one title, and C D is admitted and inſtituted on that of another.

SUPERINTENDANT, in the French cuſtoms, an officer who has the prime management and direction of the finances or revenues of the king. The term is alſo uſed for the firſt officer of the queen's houſhold, who has the chief adminiſtration thereof. They have alſo a ſuperintendant of the buildings, anſwering to the ſurveyor of the works among us.

SUPERINTENDANT alſo denotes an eccleſiaſtical ſuperior in ſeveral reformed churches, where epiſcopacy is not admitted, particularly among the Lutherans in Germany, and the Calviniſts in ſome other places. The ſuperintendant is in effect little other than a biſhop, only his power is ſomewhat more reſtrained than that of the dioceſan biſhops. He is the chief paſtor, and has the direction of all the inferior paſtors within his diſtrict or dioceſe.

SUPERIOR, or SUPERIOUR, ſomething raiſed above another, or that has a right to command another.

SUPERJURARE, was antiently a term uſed in our law where a criminal endeavoured to excuſe himſelf by his own oath, or by the oath of one or two witneſſes; and the crime charged againſt him was ſo notorious, that he was convicted upon the oaths of many more witneſſes; this was termed ſuperjurare.

SUPERLATIVE, in grammar, one of the three degrees of compariſon, being that inflexion of nouns-adjective that ſerves to augment and heighten their ſignification, and ſhews the quality of the thing denoted to be in the higheſt degree.

In Engliſh, the ſuperlative is uſually formed by the addition of *eſt* to the poſitive, as *richeſt*, *greateſt*, &c. and frequently by prefixing of *moſt*, as *moſt rich*, *moſt great*, &c.

SUPERNUMERARY, ſomething over and above a fixed number. In ſeveral of the offices are ſupernumerary clerks, to be ready on extraordinary occaſions. There are alſo ſupernumerary ſurveyors of the exciſe, to be ready to ſupply vacancies when they fall; theſe have but half-pay. In muſic, the ſupernumerary, called by the Greeks proſlambanomenos, is the loweſt of the chords of their ſyſtem, anſwering to *a*, *mi*, *la*, of the loweſt octave of the moderns.

SUPERONERATIONE PASTURÆ, in law, a judicial writ which lies againſt a perſon that is impleaded in the county-court, for ſurcharging of a common with his cattle, in a caſe where he was formerly impleaded for it in the ſame court, and the cauſe is removed into one of the courts at Weſtminſter.

SUPERPARTICULAR, SUPERPARTIENS, } See RATIO.

SUPER-PRÆROGATIVA REGIS, in law, a writ that formerly lay againſt the king's widow, for marrying without a licence.

SUPER-PURGATION, *Hypercathraſis*, in medicine, an exceſſive over-violent purging, the uſual effects of colliquating, corroſive and ſtimulating medicines. In the beginning of this diſorder, a very thin matter is evacuated: but afterwards, when the relaxation and aperture of the veſſels are increaſed, the neceſſary humours are diſcharged; there is firſt an excretion of yellow bile, then of phlegm, then of black bile, and laſt of all blood.

Thoſe who labour under a ſuperpurgation, muſt be treated with frictions of the ſkin, and a warm bath, drinking before they bathe thin, red, or yellow wine, for ſuch is eaſieſt of diſtribution, with ſops of bread, and pomegranates.

If the evacuation continues, let the limbs be bound in ſuch a manner, that the bandage may be carried from the upper to the lower parts. Exhibit alſo a ſmall quantity of theriaca, to be taken with the fleſh of vipers, or for want of that, troches of theriaca, or troches of ſeeds, and of the antidote called philonium. Cupping-glaſſes may alſo be applied to the ſtomach, and cataplaſms of polenta and mulſum; after which, you may uſe aſtringent epithems, but the greateſt relief is had from frictions of the whole body, and potable remedies. The patient ſhould keep himſelf from cold air, or what is very warm. If the evacuation ſtill continues, the aforeſaid cataplaſms ſhould be applied, and obtundents injected in clyſters, ſuch as the fat of gooſe, ſweet wine, oil of ſpike, and the like.

SUPERQUADRIPARTIENS. See the article RATIO.

SUPERSCAPULARIS INFERIOR, called alſo infraſpinatus, a muſcle that helps to draw the arm backwards. It covers all the ſpace that is between the ſpine and the teres minor, and is inſerted in the neck of the humerus.

SUPERSEDEAS, in law, according to Fitzherbert, is a writ which lies in divers caſes; and in general ſignifies a command to ſtay ſome of the ordinary proceedings in law, which, on good cauſe ſhewn, ought not to proceed. It is likewiſe uſed for ſtaying of an execution after a writ of error is allowed, and bail put in, but not before bail is given, in caſe there be a judgment upon verdict, or by default in debt, &c. A ſuperſedeas is alſo granted by the court for ſetting aſide an erroneous judicial proceſs, &c. And a priſoner may be thereby diſcharged upon entering his appearance, and on the plaintiff's not filing a declaration againſt him. For this writ is as good a cauſe to diſcharge the perſon, as the firſt proceſs is to arreſt him. There is a further writ of ſuperſedeas, where an audita querela is ſued, and in caſes of ſurety of the peace, when one is already bound to the peace in chancery, or elſewhere.

SUPERSTITION, extravagant devotion, or religion wrong directed, or conducted.

SUPERVISOR, a ſurveyor, or overſeer.

It was formerly, and ſtill remains a cuſtom among ſome perſons, to appoint a ſuperviſor of a will, to ſee that the executors thereof do punctually obſerve and perform the ſame.

Superviſor formerly was uſed for ſurveyor of the highways. There are likewiſe certain officers of the exciſe, who are called ſuperviſors, on account of their having the ſuperviſing and inſpecting of the books, &c. of the inferior officers belonging to that branch of the revenue, to prevent their neglect of duty.

SUPINATORES, in anatomy, are two muſcles, the longus and brevis; the firſt ariſeth by a fleſhy beginning three or four fingers breadth above the external extuberance of the humerus. It lies all along the radius, to whoſe inferior and external part it is inſerted by a pretty broad tendon; the laſt comes from the external and upper part of the ulna, and, paſſing round the radius, it is inſerted into its upper and fore-part below the tendon of the biceps. Theſe turn the palm of the hand upwards.

SUPINE,

SUPINE, in Latin grammar, a part of the conjugation of a verb, of a like effect with the infinitive mood.

There are two kinds of ſupines, the one in *um*, whoſe ſignification is active, and marks a motion, as *dare nuptum*; the other in *u*, having a paſſive ſignification, as *horrendum auditu*, &c.—The ſupines have neither number nor perſon.

SUPPLEMENT *of an Arch*, in geometry, or trigonometry, is the number of degrees that it wants of being an intire ſemicircle; as a complement, ſignifies what an arch wants of being a quadrant.

SUPPLEMENT, in matters of literature, an appendage to a book, to ſupply what is wanting therein.

SUPPLICAVIT, a writ iſſuing out of Chancery, for taking ſurety of the peace when one is in danger of being hurt in his body by another.

SUPPORTED, in heraldry, a term applied to the uppermoſt quarters of a ſhield when divided into ſeveral quarters, theſe ſeeming as it were ſupported or ſuſtained by thoſe below. The chief is ſaid to be ſupported when it is of two colours, and the upper colour takes up two thirds of it. In this caſe it is ſupported by the colour underneath.

SUPPORTERS, in heraldry, figures in an atchievement placed by the ſide of the ſhield, and ſeeming to ſupport or hold up the ſame. Supporters are chiefly figures of beaſts: figures of human creatures, for the like purpoſe, are properly called tenants. Some make another difference between tenant and ſupporter: when the ſhield is borne by a ſingle animal, it is called tenant; when by two, they are called ſupporters. The figures of things inanimate ſometimes placed aſide of eſcutcheons, but not touching or ſeeming to bear them, though ſometimes called ſupporters, are more properly cotiſes.

The ſupporters of the Britiſh arms are a lion and an unicorn: thoſe of the French arms are angels, &c.

In England, none under the degree of a banneret are allowed ſupporters, which are reſtrained to thoſe called the high nobility. The Germans permit none but princes and noblemen of rank to bear them: but among the French the uſe of them is more promiſcuous.

SUPPOSITION, in muſic, is when one of the parts dwells on a note, while another part makes two or more leſſer notes equivalent to it, by conjoint degree. See HARMONY.

SUPPOSITORY, *Suppoſitorium*, in pharmacy, a kind of medicated cone, or ball, which is introduced to the anus for opening the belly. Suppoſitories are uſually made of ſoap, ſugar, alum, or a piece of tallow-candle, about the length of a man's thumb and the breadth of a finger, though they may be made ſmaller for children, and ſometimes a little thicker for adults. Suppoſitories are ſometimes compounded of ingredients adapted to the diſeaſe and circumſtances of the patient, as of honey, ſalt, powder of aloes, colocynthia, and the like. If one ſuppoſitory does not occaſion a ſtool, it muſt be followed by another ſtronger one; and if that does not ſucceed, the repetition muſt be continued till the effect required is produced. They are ſometimes lubricated with oil or butter, that they may be introduced with greater eaſe. Some uſe a lozenge of ſugar, or a piece of thin linen cloth rolled up with a little lard or ſalt butter, which greatly looſens the belly. For ulcers of the rectum, the beſt ſuppoſitories are made of honey of roſes, powder of maſtich and myrrh, or of colophony. The ſtronger ſuppoſitories, which are compoſed of acrid and ſtimulating ingredients, are advantageouſly uſed in promoting a difficult birth, if the infant be in a natural poſition; and alſo for expelling the ſecundines when they are tenaciouſly retained in the uterus. In exhibiting them the patient ſhould be put in the ſame poſture as in giving a clyſter, and the ſuppoſitory muſt be gently thruſt up the anus with the finger.

SUPPRESSION, in law, the extinction or annihilation of an office, right, rent, or the like.

SUPPRESSION, in grammar and rhetoric, denotes an omiſſion of certain words in a ſentence, which yet are neceſſary to full and perfect conſtruction: as, "I come from my father's;" that is, "from my father's houſe."

Suppreſſion is a figure of ſpeech very frequent in our language, chiefly uſed for brevity and elegance. Some rules relating hereto are as follow: 1. Whenever a word comes to be repeated in a ſentence oftener than once, it is to be ſuppreſſed. Thus we ſay, "This is my maſter's horſe," not "This horſe is my maſter's horſe." 2. Words that are neceſſarily ſupplied may be ſuppreſſed: and 3. All words that uſe and cuſtom ſuppreſs in other languages, are alſo to be ſuppreſſed in Engliſh, unleſs there be particular reaſons for the contrary.

Suppreſſion is alſo a figure in ſpeech whereby a perſon in rage, or other diſturbance of mind, ſpeaks not out all he means, but ſuddenly breaks off his diſcourſe. Thus the gentleman in Terence extremely incenſed againſt his adverſary, accoſts him with this abrupt ſaying, "Thou of all." The exceſs of his indignation and rage choaked the paſſage of his voice, and would not ſuffer him to utter the reſt. But in theſe caſes, though the diſcourſe is not complete, the meaning is readily underſtood, and the evidence of the thought eaſily ſupplies the defect of words. Suppreſſion ſometimes proceeds from modeſty, and fear of uttering any word of ill and offenſive ſound.

SUPPRESSION, in medicine, is generally uſed for a retention of urine or the menſes.

SUPPRESSIONIS IGNIS, a fire of ſuppreſſion, a term uſed in chemiſtry to expreſs ſuch an application of fire to any ſubject that it ſhall at once act upon it, both above and below, in the ſame manner. The uſual way of giving this heat is by covering the veſſel in which the ingredients are put with ſand, and then laying hot coals upon that, ſo that they may heat through the ſand downwards.

SUPPURATION, in medicine and ſurgery, the ſecond way wherein an inflammation terminates, being a converſion of the inſpiſſated blood and the ſoft adjacent parts, as the veſſels and fat, into pus, or matter: which diſorder, when it has not yet found an opening, is generally called an abſceſs.

The beſt cure of an inflammation is by reſolution or diſperſion; but when this is out of the power of the ſurgeon or phyſician to effect, and when tumours and phlegmons ſhew a tendency to ſuppuration, all the reſolving and diſperſing medicines muſt be laid aſide, and great care muſt be taken to forward the maturity of the inflammation; that is, to convert the ſtagnated blood into laudable matter; then to give a diſcharge or vent to this ſuppurated matter; afterwards to cleanſe the part; and finally to incarn and heal it.

In general, ſuppuration is to be promoted by ſuch of the emollient medicines as obſtruct the pores of the ſkin, as fats, oils, and glutinous medicines, which may be uſed in form of cataplaſms or plaſters. But to be more particular, ſuppurating medicines are the fats of a gooſe, of a dog, of a man, of a viper, and of a bear; pigeon and cow-dung; bran, yeaſt, herrings, leeches, melilot, tobacco, oil, burgundy pitch, common-pitch, roſin, deer-ſuet, ox-ſuet, ſheep-ſuet, and frankincenſe. Theſe medicines, either alone or compounded, are to be applied hot to the part, and the application frequently repeated, till the matter within is found to be ſufficiently ripened by the ſoftneſs and whiteneſs of the tumour: but when the abſceſs is ſmall, it is ſufficient and more convenient to apply ſome of the ripening plaſters, as diachylon with the gums, or the like, till the ſuppuration is perfected.

In general, it is to be obſerved, that ſuppurative medicines are ſuch as by the activity and warmth of their parts are able to penetrate the pores, and mix with and rarify any obſtructed matter, ſo that it may be rendered fit to diſcharge, upon laying open the part by a cauſtic or inciſion. Now, in many inſtances, as the matter by this means rarifies and grows more fluid, the refluent blood is apt to waſh it back into the common maſs, which ſometimes is of that nature as to do a great deal of miſchief; or by making it take up more room upon its rarefaction, occaſions it more to diſtend the parts in which it is contained, whereon a ſenſe of pain is excited, and thereby a greater concourſe of fluid, and conſequently a needleſs increaſe of the tumour; ſo that medicines under this denomination require to be in the hand of ſuch as are ſo well acquainted with the mechaniſm of the animal œconomy as to be able to apply them to the beſt advantage, and know how to avoid the hazards which

may arise from their abuse. Nor are internal remedies to be neglected in order to further a suppuration, especially when the tumours are large and of consequence. In these cases, when the blood moves too slowly, which may be known by the pulse, the patient must be allowed to eat meat, and must take such medicines as are warm and stimulating, by means of which, and by the increased motion of the blood, the inspissated particles contained in the smaller vessels will be the more easily converted into matter. Strong broths are very proper for this purpose, as also the use of wine, or ale, in moderation; and Venice treacle, diascordium, and the confection of alkermes, are to be the medicines taken three or four times a day, and medicated teas made of saunders-wood, sassafras, or cinnamon. But on the contrary, when the motion of the blood is too violent, and the heat too great, cooling medicines are to be given, such as the thin and watery drinks, the sub-acid medicines, and nitre: bleeding in a small quantity is also often necessary in this case. But when the constitution is sound, and the blood's motion regular, the use of internal medicines to promote suppuration is trifling, and may be altogether rejected.

SUPPURATIVES, or SUPPURATING MEDICINES, such as promote suppuration.

SUPPUTATION. See COMPUTATION.

SUPRACOSTALES, or LEVATORES COSTARUM, in anatomy, muscles serving to respiration; being among those that dilate the thorax for that end, and therefore reckoned among the dilatores.

These muscles are of two kinds, being distinguished from their figures into short and long. The short ones are twelve on each side; they have their origin from the transverse processes of eleven vertebræ of the back, and of one that is in the lower one of the neck, and they are inserted into the hinder part of the ribs. The long supracostales are three or four: their origin is the same from the seventh, eighth, ninth, and tenth vertebræ, and their end in the ninth, tenth, eleventh, and twelfth ribs.

SUPRALAPSARY, in theology, a person who holds that God, without any regard to the good or evil works of men, has resolved, by an eternal decree, to save some and damn others. These are also called antelapsaries, and are opposed to sublapsaries and infralapsaries.

SUPRASPINATUS, in anatomy, a muscle thus called from its fleshy origination at the upper end of the basis of the scapula above the spine, to the upper part whereof it is connected, as also to the superior edge of the scapula, whence marching along the upper interscapulum, or thin part of the scapula, which it fills, it passes under the acromium, and articulation of the humerus. It helps to lift the arm upwards.

SUPREMACY, in our polity, the superiority or sovereignty of the king over the church as well as state, whereof he is established head.

The king's supremacy was at first established, or, as others say, recovered, by king Henry VIII. in 1534, after breaking with the pope. It is since confirmed by several canons, as well as by the articles of the church, and is passed into an oath which is required as a necessary qualification for all offices and employments both in church and state, from persons to be ordained, from the members of both houses of parliament, &c.

SURA, in anatomy, the calf, or fleshy part of the leg. The word is also used by some for the fibula. See FIBULA.

SURBATING, among farriers, is when the sole of a horse's foot is worn, bruised, or spoiled by beating the hoof against the ground in travelling without shoes, or going in hot sandy lands, or with a shoe that hurts the sole, lies too flat to it, or the like. Sometimes also it happens by over-riding a horse while young, before his feet are hardened; and sometimes by the hardness of the ground and high lifting his feet. The signs hereof are his halting on both fore-legs, and going stiffly, and creeping as if half foundered. In the general, there is nothing better for surbated feet than tar melted into the foot, or vinegar boiled with soot to the consistence of a broth, and put into the foot boiling hot, with hurds over it, and splints to keep it in.

SURCHARGE, the same with overcharge, and whatever is above that which is just and right. Surcharge of the forest or a common, is when a commoner puts more beasts in the forest or common than he has a right to do.

SURCINGLE, a girdle wherewith the clergy of the church of England usually tie their cassock.

SURCOAT, a coat of arms to be worn over the body armour.

The surcoat is properly a loose thin taffaty-coat, with arms embroidered or painted on it, such as is worn by heralds: anciently also used by military men over their armour, to distinguish themselves by.

SURCULUS, in the anatomy of plants, a word used to express that part of the branching of the ribs of a leaf, which is of a middle kind betwixt the great middle rib and the smallest reticular ramifications. The middle rib is by the writers on these subjects called petiolum. The first division that go off laterally from these are called rami, or branches; the next division of these into more minute ones, furculi; and the final divarications of these into the reticular work that spreads itself over the whole leaf, capillamenta.

SURD, in arithmetic and algebra, implies any number or quantity that is incommensurable to unity; and is otherwise called an irrational number or quantity.

If a lesser quantity measures a greater so as to leave no remainder, as $2a$ measures $10a$, being found in it five times, it is said to be an aliquot part of it, and the greater is said to be a multiple of the lesser. The lesser quantity in this case is the greatest common measure of the two quantities; for as it measures the greater, so it also measures itself, and no quantity can measure it that is greater than itself.

When a third quantity measures any two proposed quantities, as $2a$ measures $6a$ and $10a$, it is said to be a common measure of these quantities; and if no greater quantity measure them both, it is called their greatest common measure.

Those quantities are said to be commensurable which have any common measure; but if there can be no quantity found that measures them both, they are said to be incommensurable; and if any one quantity be called rational, all others that have any common measure with it, are also called rational: but those that have no common measure with it, are called irrational quantities.

If any two quantities a and b have any common measure x, this quantity x shall also measure their sum or difference $a \mp b$. Let x be found in a as many times as unit is found in m, so that $a = mx$, and in b, as many times as unit is found in n, so that $b = nx$; then shall $a \mp b = mx \mp nx = \overline{m \mp n}x$: so that x shall be found in $a \mp b$, as often as unit is found in $m \mp n$: now since m and n are integer numbers, $m \mp n$ must be an integer number or unit, and therefore x must measure $a \mp b$.

It is also evident, that if x measure any number as a, it must measure any multiple of that number. If it be found in a as many times as unit is found in m, so that $a = mx$, then it will be found in any multiple of a, as na, as many times as unit is found in mn; for $na = mnx$.

If two quantities a and b are proposed, and b measure a by the units that are in m (that is, be found in a as many times as unit is found in m) and there be a remainder c, and if x be supposed to be a common measure of a and b, it shall be also a measure of c. For by the supposition $a = mb + c$, since it contains b, as many times as there are units in m, and there is c besides of remainder. Therefore $a - mb = c$. Now x is supposed to measure a and b, and therefore it measures mb, and consequently $a - mb$ which is equal to c.

If c measures b by the units in n, and there be a remainder d, so that $b = nc + d$, and $b - nc = d$, then shall x also measure d; because it is supposed to measure b, and it has been proved that it measures c, and consequently nc, and $b - nc$, which is equal to d. Whence, as after subtracting b as often as possible from a, the remainder c is measured by x; and after subtracting c as often as possible from b, the remainder d, is also measured by x; so for the

the ſame reaſon, if you ſubtract d, as often as poſſible from c, the remainder (if there be any) muſt ſtill be meaſured by x: and if you proceed, ſtill ſubtracting every remainder from the preceding remainder, till you find ſome remainder which ſubtracted from the preceding leaves no further remainder, but exactly meaſures it, this laſt remainder will ſtill be meaſured by x, any common meaſure of a and b.

The laſt of theſe remainders, viz. that which exactly meaſures the preceding remainder, muſt be a common meaſure of a and b; ſuppoſe that d was this laſt remainder, and that it meaſured c by the units in r, then ſhall $c=rd$, and we ſhall have theſe equations,

$$a=mb+c$$
$$b=nc+d$$
$$c=rd.$$

Now it is plain that ſince d meaſures c, it muſt alſo meaſure nc, and therefore muſt meaſure $nc+d$, or b. And ſince it meaſures b and c, it muſt meaſure $mb+c$, or a; ſo that it muſt be a common meaſure of a and b. But further, it muſt be their greateſt common meaſure; for every common meaſure of a and b muſt meaſure d: and the greateſt number that meaſures d, is itſelf, which therefore is the greateſt common meaſure of a and b.

But if, by continually ſubtracting every remainder from the preceding remainder, you can never find one that meaſures that which precedes it, exactly, no quantity can be found that will meaſure both a and b; and therefore they will be incommenſurable to each other.

For if there was any common meaſure of theſe quantities, as x, it would neceſſarily meaſure all the remainders c, d, &c. For it would meaſure $a-mb$, or c, and conſequently $b-nc$, or d; and ſo on; now theſe remainders decreaſe in ſuch a manner, that they will neceſſarily become at length leſs than x, or any aſſignable quantity. For c muſt be leſs than $\frac{1}{2}a$; becauſe c is leſs than b, and therefore leſs than mb, and conſequently leſs than $\frac{1}{2}c+\frac{1}{2}mb$, or $\frac{1}{2}a$. In like manner d muſt be leſs than $\frac{1}{2}b$, for d is leſs than c, and conſequently leſs than $\frac{1}{2}d+\frac{1}{2}nc$, or $\frac{1}{2}b$. The third remainder, in the ſame manner muſt be leſs than $\frac{1}{2}c$, which is itſelf leſs than $\frac{1}{2}a$: Thus theſe remainders decreaſe ſo that every one is leſs than the half of that which preceded it next but one. Now if from any quantity you take away more than its half, and from the remainder, more than its half, and proceed in this manner, you will come at a remainder leſs than any aſſignable quantity. It appears therefore that if the remainders c, d, &c. never end, they will become leſs than any aſſignable quantity, as x, which therefore cannot poſſibly meaſure them, and therefore cannot be a common meaſure of a and b.

In the ſame way, the greateſt common meaſure of two numbers is diſcovered. Unit is a common meaſure of all integer numbers, and two numbers are ſaid to be prime to each other, when they have no greater common meaſure than unit. Such as 9 and 25. Such always are the leaſt numbers that can be aſſumed in any given proportion; for if theſe had any common meaſure, then the quotients that would ariſe by dividing them by that common meaſure would be in the ſame proportion, and being leſs than the numbers themſelves, theſe numbers would not be the leaſt in the ſame proportion; againſt the ſuppoſition.

The leaſt numbers in any proportion always meaſure any other numbers that are in the ſame proportion. Suppoſe a and b to be the leaſt of all integer numbers in the ſame proportion, and that c and d, are other numbers in that proportion, then will a meaſure c, and b meaſure d.

For if a and b are not aliquot parts of c and d, then they muſt contain the ſame number of the ſame kind of parts of c and d, and therefore dividing a into parts of c, and b into an equal number of like parts of d, and calling one of the firſt m, and one of the latter n; then as m is to n, ſo will the ſum of all the m's, be to the ſum of all the n's; that is, $m:n::a:b$, therefore a and b will not be the leaſt in the ſame proportion; againſt the ſuppoſition. Therefore a and b muſt be aliquot parts of c and d. Hence we ſee that numbers which are prime to each other are the leaſt in the ſame proportion; for if there were others in the ſame proportion leſs than them, theſe would meaſure them by the ſame number, which therefore would be their common meaſure againſt the ſuppoſition, for we ſuppoſed them to be prime to each other.

If two numbers a and b are prime to one another, and a third number c meaſures one of them a, it will be prime to the other b. For if c and b were not prime to each other, they would have a common meaſure, which becauſe it would meaſure c, would alſo meaſure a, which is meaſured by c, therefore a and b would have a common meaſure; againſt the ſuppoſition.

If two numbers a and b are prime to c, then ſhall their product ab be alſo prime to c: For if you ſuppoſe them to have any common meaſure as d, and ſuppoſe that d meaſures ab by the units in e, ſo that $de=ab$, then ſhall $d:a::b:e$. But ſince d meaſures c, and c is ſuppoſed to be prime to a, it follows that d and a are prime to each other; and therefore d muſt meaſure b; and yet ſince d is ſuppoſed to meaſure c which is prime to b, it follows that d is alſo prime to b: that is, d is prime to a number which it meaſures, which is abſurd.

It follows that if a and c are prime to each other, then a^2 will be prime to c: For by ſuppoſing that a is equal to b, then ab will be equal to a^2; and conſequently a^2 will be prime to c. In the ſame manner c^2 will be prime to a.

If two numbers a and b, are both prime to other two c, d, then ſhall the product ab be prime to the product cd; for ab will be prime to c and alſo to d, and therefore cd will be prime to ab.

From this it follows, that if a and c are prime to each other, then ſhall a^2 be prime to c^2, by ſuppoſing, in the laſt, that $a=b$, and $c=d$. It is alſo evident that a^3 will be prime to c^3, and in general any power of a to any power of c whatſoever.

Any two numbers, a and b, being given, to find the leaſt numbers that are in the ſame proportion with them, divide them by their greateſt common meaſure x, and the quotients c and d ſhall be the leaſt numbers in the ſame proportion with a and b.

For if there could be any other numbers in that proportion leſs than c and d, ſuppoſe them to be e and f, and theſe being in the ſame proportion as a and b would meaſure them: And the number by which they would meaſure them, would be greater than x, becauſe e and f are ſuppoſed leſs than c and d, ſo that x would not be the greateſt common meaſure of a and b; againſt the ſuppoſition.

Let it be required to find the leaſt number that any two given numbers as a and b can meaſure. Firſt, if they are prime to each other, then their product ab is the leaſt number which they can both meaſure.

For if they could meaſure a leſs number than ab as c, ſuppoſe that c is equal to ma, and to nb; and ſince c is leſs than ab, therefore ma will be leſs than ab, and m leſs than b; and nb being leſs than ab, it follows that n muſt be leſs than a; but ſince $ma=nb$, and conſequently $a:b::n:m$, and a and b are prime to each other, it would follow that a would meaſure n, and b meaſure m, that is a greater number would meaſure a leſs, which is abſurd.

But if the numbers a and b are not prime to each other, and their greateſt common meaſure is x, which meaſures a by the units in m, and meaſures b by the units in n, ſo that $a=mx$, and $b=nx$, then ſhall an (which is equal to bm, becauſe $a:b::mx:nx::m:n$, and therefore $an=bm$) be the leaſt number that a and b can both meaſure. For if they could meaſure any number c leſs than na, ſo that $c=la=kb$, then $a:b::m:n::k:l$; and becauſe x is ſuppoſed to be the greateſt common meaſure of a and b, it follows that m and n are the leaſt of all numbers in the ſame proportion, and therefore m meaſures k, and n meaſures l. But as c is ſuppoſed to be leſs than na, that is, la leſs than na, therefore l is leſs than n, ſo that a greater would meaſure a leſſer, which is abſurd. Therefore a and b cannot meaſure any number leſs than an; which they both meaſure becauſe $na=mb$.

It follows from this reaſoning, that if a and b meaſure any quantity c, the leaſt quantity na which is meaſured by a and b, will alſo meaſure c. For if you ſup-

pose as before that $c=la$, you will find that n must measure l, and na must measure la or c.

Let a express any integer number, and $\frac{m}{n}$ any fraction reduced to its lowest terms, so that m and n may be prime to each other, and consequently $an+m$ also prime to n, it will follow that $\overline{an+m}^2$ will be prime to n^2, and consequently $\frac{\overline{an+m}^2}{n^2}$ will be a fraction in its least terms, and can never be equal to an integer number. Therefore the square of the mixt number $a+\frac{m}{n}$ is still a mixt number and never an integer. In the same manner the cube, biquadrate, or any power of a mixt number, is still a mixt number and never an integer. It follows from this, that the square root of an integer must be an integer or an incommensurable. Suppose that the integer proposed is B, and that the square root of it is less than $a+1$, but greater than a, then it must be an incommensurable; for if it is a commensurable, let it be $a+\frac{m}{n}$, where $\frac{m}{n}$ represents any fraction reduced to its least terms: it would follow that $a+\frac{m}{n}$ squared would give an integer number B, the contrary of which we have demonstrated.

It follows from the last paragraph, that the square roots of all numbers but of 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, &c. (which are the squares of the integer numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, &c.) are incommensurables; after the same manner, the cube roots of all numbers but of the cubes of 1, 2, 3, 4, 5, 6, 7, 8, 9, &c. are incommensurables: and quantities that are to one another in the proportion of such numbers must also have their square roots or cube roots incommensurable.

The roots of such numbers being incommensurable are expressed therefore by placing the proper radical sign over them; thus, $\surd^2 2$, $\surd^2 3$, $\surd^2 5$, $\surd^2 6$, $\surd 7$, $\surd 8$, $\surd 10$, &c. express numbers incommensurable with unit. These numbers, tho' they are incommensurable themselves with unit, are commensurable in power with it, because their powers are integers, that is, multiples of unit. They may also be commensurable sometimes with one another, as the $\surd^2 8$, and the $\surd^2 2$, because they are to one another as 2 to 1: And when they have a common measure, as $\surd^2 2$ is the common measure of both, then their ratio is reduced to an expression in the least terms, as that of commensurable quantities, by dividing them by their greatest common measure. This common measure is found as in commensurable quantities, only the root of the common measure is to be made their common divisor. Thus, $\frac{\surd 12}{\surd 3}=\surd 4=2$, and $\frac{\surd 18a}{\surd 2}=3\surd a$.

A rational quantity may be reduced to the form of any given surd, by raising the quantity to the power that is denominated by the name of the surd, and then setting the radical sign after it thus, $a=\surd^2 a^2=\surd^3 a^3=\surd^4 a^4=\surd^5 a^5=\surd^n a^n$, and $4=\surd 16=\surd^3 64=\surd^4 259=\surd^5 1024=\surd^n 4^n$.

As surds may be considered as powers with fractional exponents, they are reduced to others of the same value that shall have the same radical sign by reducing these fractional exponents to fractions having the same value and a common denominator. Thus $\surd^n a=a^{\frac{1}{n}}$ and $\surd^m a=a^{\frac{1}{m}}$, and $\frac{1}{n}=\frac{m}{nm}$, $\frac{1}{m}=\frac{n}{nm}$, and therefore $\surd^n a$ and $\surd^m a$, reduced to the same radical sign, become $\surd\overline{a^m}^{nm}$ and $\surd\overline{a^n}^{nm}$. If you are to reduce $\surd^2 3$ and $\surd^3 2$ to the same denominator, consider $\surd^2 3$ as equal to $3^{\frac{1}{2}}$, the $\surd^3 2$ as equal to $2^{\frac{1}{3}}$, whose indices reduced to a common denominator, you have $3^{\frac{1}{2}}=3^{\frac{3}{6}}$ and $2^{\frac{1}{3}}=2^{\frac{2}{6}}$, and consequently $\surd^2 3=\surd^6 3^3=\surd^6 27$, and $\surd^3 2=\surd^6 2^2=\surd^6 4$; so that the proposed surds $\surd^2 3$ and $\surd^3 2$ are reduced to other equal surds $\surd^6 27$ and $\surd^6 4$, having a common radical sign.

Surds of the same rational quantity are multiplied by adding their exponents, and divided by subtracting them; thus, $\surd^2 a\times\surd^3 a=a^{\frac{1}{2}}\times a^{\frac{1}{3}}=a^{\frac{3+2}{6}}=a^{\frac{5}{6}}=\surd\overline{a^5}^6$; and $\frac{\surd^3 a}{\surd^5 a}=\frac{a^{\frac{1}{3}}}{a^{\frac{1}{5}}}=a^{\frac{1}{3}-\frac{1}{5}}=a^{\frac{5-3}{15}}=a^{\frac{2}{15}}=\surd^{15}a^2$; $\surd^m a\times\surd^n a=a^{\frac{m+n}{mn}}$; $\frac{\surd^m a}{\surd^n a}=a^{\frac{n-m}{mn}}$; $\surd^2 2\times\surd^3 2=\surd^6 2^5=\surd^6 32$; $\frac{\surd^2 2}{\surd^3 2}=\surd^6 2$.

If the surds are of different rational quantities, as $\surd\overline{a^2}^n$ and $\surd\overline{b^3}^n$, and have the same sign, multiply these rational quantities into one another, or divide them by one another, and set the common radical sign over their product or quotient. Thus, $\surd\overline{a^2}^n\times\surd\overline{b^3}^n=\surd\overline{a^2b^3}^n$; $\surd^2 2\times\surd^2 5=\surd^2 10$; $\frac{\surd\overline{a^4}^m}{\surd\overline{b^3}^m}=\surd\frac{\overline{a^4}^m}{\overline{b^3}^m}=\surd\frac{\overline{a^3}^m}{b^3}$; $\frac{\surd\overline{9}^3}{\surd\overline{24}^3}=\surd\frac{9}{24}=\surd\frac{3}{8}=\frac{1}{2}\surd^3 3$.

If the surds have not the same radical sign, reduce them to such as shall have the same radical sign, and proceed as before, $\surd^m a\times\surd^n b=\surd\overline{a^n b^m}^{nm}$; $\frac{\surd^m a}{\surd\overline{x}^n}=\surd\frac{\overline{a^n}^{mn}}{\overline{x^m}}$; $\surd^2 2\times\surd^3 4=2^{\frac{1}{2}}\times 4^{\frac{1}{3}}=2^{\frac{3}{6}}\times 4^{\frac{2}{6}}=\surd\overline{2^3\times 4^2}^6=\surd\overline{8\times 16}^6=\surd\overline{128}^6$; $\frac{\surd\overline{4}^3}{\surd\overline{2^2}^3}=\frac{4^{\frac{1}{3}}}{2^{\frac{1}{2}}}=\frac{4^{\frac{2}{6}}}{2^{\frac{3}{6}}}=\surd\frac{\overline{4^2}^6}{2^3}=\surd\frac{\overline{16}^6}{8}=\surd\overline{2}^{-6}$. If the surds have any rational coefficients, their product or quotient must be prefixed; thus, $2\surd^2 3\times 5\surd^2 6=10\surd^2 18$.

The powers of surds are found as the powers of other quantities, by multiplying their exponents by the index of the power required; thus, the square of $\surd^3 2$ is $2^{\frac{1}{3}\times 2}=2^{\frac{2}{3}}=\surd^3 4$; the cube of $\surd^2 5=5^{\frac{1}{2}\times 3}=5^{\frac{3}{2}}=\surd^2 125$. Or you need only, in involving surds, raise the quantity under the radical sign to the power required, continuing the same radical sign; unless the index of that power is equal to the name of the surd, or a multiple of it, and in that case the power of the surd becomes rational. Evolution is performed by dividing the fraction, which is the exponent of the surd, by the name of the root required. Thus the square root of $\surd\overline{a^4}^3$ is $\surd\overline{a^2}^3$ or $\surd\overline{a^4}^6$.

The surd $\surd\overline{a^m x}^m=a\surd\overline{x}^m$; and, in like manner, if a power of any quantity of the same name with the surd divides the quantity under the radical sign without a remainder, as here a^m divides $a^m x$, and 25 the square of 5 divides 75 the quantity under the sign in $\surd\overline{75}^2$ without a remainder: then place the root of that power rationally before the sign, and the quotient under the sign, and thus the surd will be reduced to a more simple expression. Thus $\surd^2 75=5\surd 3$; $\surd^2 48=\surd\overline{3\times 16}^2=4\surd^2 3$; $\surd^3 81=\surd\overline{27\times 3}^3=3\surd^3 3$.

When surds are reduced to their least expressions, if they have the same irrational part, they are added or subtracted, by adding or subtracting their rational coefficients, and prefixing the sum or difference to the common irrational part. Thus, $\surd^2 75+\surd^2 48=5\surd 3+4\surd 3=9\surd 3$; $\surd^3 81+\surd^3 24=3\surd^3 3+2\surd^3 3=5\surd^3 3$; $\surd^2 150-\surd^2 54=5\surd 6-3\surd 6=2\surd 6$; $\surd a^2 x+\surd b^2 x=a\surd x+b\surd x=a+b\times\surd x$.

Compound surds are such as consist of two or more joined together. The simple surds are commensurable in power, and by being multiplied into themselves give at length rational quantities; yet compound surds multiplied into themselves commonly give still irrational products.

ducts. But, when any compound ſurd is propoſed, there is another compound ſurd which multiplied into it gives a rational product. Thus $\sqrt{a}+\sqrt{b}$ multiplied by $\sqrt{a}-\sqrt{b}$ gives $a-b$, and the inveſtigation of that ſurd which multiplied into the propoſed ſurd will give a rational product.

SURETY, in law, generally ſignifies the ſame with bail.

There is alſo a ſurety of the peace, whereby a perſon, in danger of hurt from another, is ſecured by a bond or recognizance, acknowledged by the other to the king, and bail bound with him for keeping the peace.

SURFEIT, in medicine, a ſickneſs proceeding from the ſenſation of a load at the ſtomach, uſually attended with eruptions, and ſometimes with a fever.

Surfeits may be cauſed, ſays Dr. Shaw, 1. By voracity; from whence the ſtomach and inteſtines are overcharged, digeſtion weakened, and the chyle rendered crude or viſcid, and the blood corrupted. If what was thus devoured were high ſeaſoned or inflammatory, or happened to lie longer in the body, it is ſuppoſed to cauſe a fever alſo. 2. By drinking of ſmall liquors in hot weather, or when the body is heated by exerciſe; which, perhaps, chills the fluids, and gives a check to perſpiration; from whence alſo may ariſe a fever and eruptions. Summer fruits likewiſe, as cucumbers, apples, cherries, &c. may have the ſame effect. 3. By too great exerciſe or heat, whence the fluids are rarified and thrown into too rapid a circulation, which being ſuddenly ſtopped, as may happen by cooling too faſt, there enſues alſo a ſtoppage of perſpiration. 4. By the ſtate or ſome change of the air; as by blaſts, or vehemently hot and ſultry weather, or cold winds giving a check to, and preventing, perſpiration.

Eruptions may not appear in ſurfeits, either by reaſon of the ſlightneſs of the cauſe, or ſome wrong management at the firſt. Nauſea's, oppreſſion, ſickneſs, and ſometimes a vomiting and a fever, but ſeldom eruptions, attend on an overloaded ſtomach. This ſpecies of a ſurfeit is called crapula; ſickneſs, gnawing at the ſtomach, ſometimes eruptions and a fever attend ſurfeits, from the bad quality of any thing uſed as food. The fever always decreaſes as the eruptions increaſe; and if theſe ſuddenly diſappear, the fever increaſes. Thoſe ſurfeits, which proceed from too great exerciſe, or too ſudden cooling after it, appear with ſickneſs, a fever and eruptions, though the two laſt may be wanting. Thoſe cauſed from ſome alteration in the air, and vulgarly called blaſts, appear with redneſs of the face, ſpots, and a fever, often with bliſters on the ſkin.

SURGERY, or CHIRURGERY. See the article CHIRURGERY.

SURMOUNTED, in heraldry, is when one figure is laid over another.

SURNAME, or SIRNAME, a name added to the proper or baptiſmal name to denominate the perſon of ſuch a family.

SURREBUTTER, in law, a ſecond rebutter, or the replication of the plaintiff to the defendant's rebutter.

SURRENDER, in common law, an inſtrument in writing, teſtifying, that the particular tenant of lands and tenements for life, or years, doth ſufficiently conſent and agree, that he who has the next or immediate remainder or reverſion thereof, ſhall have the preſent eſtate of the ſame in poſſeſſion, and that he hereby yields and gives up the ſame to him.

SURSOLID, or SURDESOLID, in arithmetic and algebra, the fifth power, or fourth multiplication of any number or quantity conſidered as a root.

SURSOLID PROBLEM, in mathematics, is that which cannot be reſolved but by curves of a higher nature than a conic ſection; v. gr. in order to deſcribe a regular endecagon, or figure of eleven ſides in a circle, it is required to deſcribe an iſoſceles triangle on a right line given, whoſe angles at the baſe ſhall be quintuple to that at the vertex; which may eaſily be done by the interſection of a quadratrix, or any other curve of the ſecond gender.

SURVEYING, the art or act of meaſuring lands; i. e. of taking the dimenſions of any tract of ground, laying down the ſame in a map or draught, and finding the content or area thereof.

Surveying, called alſo geodæſia, is a very ancient art; it is even held to have been the firſt or primitive part of geometry, and that which gave occaſion to, and laid the foundation of all the reſt.

Surveying conſiſts of three parts or members; the firſt is the taking of the neceſſary meaſures, and making the neceſſary obſervations on the ground itſelf: the ſecond is the laying down of theſe meaſures and obſervations on paper: and the third, the finding the area or quantity of the ground thus laid down. The firſt is what we properly call ſurveying: the ſecond we call plotting or protracting, or mapping: and the third caſting up.

The firſt, again, conſiſts of two parts, viz. the making of obſervations for the angles, and the taking of meaſures for the diſtances.

The former of theſe is performed by ſome one or other of the following inſtruments, viz. the theodolite, circumferentor, ſemi-circle, plain table, or compaſs: the deſcription and manner of uſing each whereof, ſee under its reſpective article.

The latter is performed by means either of the chain or the perambulator: the deſcription and manner of applying each whereof, ſee under its reſpective article.

The ſecond branch of ſurveying is performed by means of the protractor, and plotting ſcale. See the article PLOTTING.

The third is performed by reducing the ſeveral diviſions, incloſures, &c. into triangles, ſquares, trapeziums, parallelograms, &c. but eſpecially triangles; and finding the areas or contents of theſe ſeveral figures.

SURVEYING *Harbours*.—Let plate CXXIII. *fig.* 5. repreſent the place which it is required to ſurvey and draw a map of.

1. It will be requiſite to have ſome idea of the place to be ſurveyed, therefore it will be neceſſary, before the work is begun, to walk ſeveral times along the coaſt, carefully obſerving the ſeveral particulars neceſſary to be taken notice of.

2. Having acquired an idea of the place, ſignals muſt be erected at every angle, &c. as at C, D, E, F, G, H, and I; alſo at the ends of the ſands, &c. as at Q, S, T, V, W, X, Y, and Z. And when you are at the point Q, erecting the ſignal, obſerve what objects on the land are in a right line, which are the windmill at *t* and the church at K, which objects muſt be inſerted in your map as a mark for ſhips to avoid the ſand Q T W. Likewiſe, when you are in the midſt of the channel between the ends of the ſands W and X, obſerve what objects are in a direct line, which are the houſe at *w*, and the church at O. In like manner when you are at *y*, the two windmills at P and L will be in a right-line, as will the windmill at P and the church at K when you are at Z. Theſe objects you muſt be careful to inſert in your map, and, if there be none that will anſwer the intention, ſome ought to be erected.

3. The ſignals, &c. being erected, place your inſtrument at A, and obſerve the bearing of the ſignal at C; alſo the ſeveral angles comprehended between the lines A Q, A S, A T, A Y, and A Z, and the line A C. And, becauſe the object at X will be in a right-line with that at T, therefore the angle will be the ſame.

4. Meaſure along the line A C with your chain or perambulator, and, when you come to R, note down the diſtance from A to R, and, fixing your inſtrument in the ſame ſituation as at A, obſerve the angles intercepted between the lines R V and R W and the line R C. And, becauſe the windmill at *t* is in a perpendicular direction to the line A C in the point R, meaſure the diſtance from thence to that windmill, noting it down alſo in your book.

5. Continue the meaſuring of the line A C from R towards C, obſerving if the edge of the water is not parallel to the line A C, to meaſure the diſtance in a perpendicular direction, as the ſmall perpendiculars *a*, *b*, *c*, &c. but be ſure to remark the diſtance ſuch perpendiculars are from the point A, or firſt ſtation. Alſo, when you perceive that the windmill at P is in a perpendicular direction to the line A C, meaſure the diſtance *d* P.

6. When

6. When you have measured to B, fix your instrument there in the same position as at A, and observe the angles which the lines BY and BZ form with the line BC. Then turn the instrument about (the index being fixed at the beginning of the graduations) till through the sights you see the object at A, and fix the instrument by the screw in that position; then observe the angles comprehended between the line BA and the lines BX, BW, BV, BS, BT, and BQ. Also turning about the brass limb of the instrument (the index being fixed at the beginning of the graduations) till the two sights be in a right-line with the object at A, and, fastening the instrument in this position, take the angles intercepted between the line BA and the lines BM, BL, and BK, and measure the distance BM.

7. Having measured the whole line AC, fix your instrument at C in the same position as before, and take the angles BCD, and DCE, measuring the distance CD and the perpendicular *f*.

8. Remove your instrument to D, and take the angle CDE; that is, place the instrument at D, and, having fixed the index at the beginning of the graduations, turn the instrument about till you perceive through the sights the object at C, and fix the instrument in that position; then move the index till you see through the sights the object at E, and the degrees cut by the index will be the angle required.

9. Remove the instrument to M, and take the angles KMB and KML after the preceding manner.

10. Having observed the angles and measured the distances requisite on the west side of the harbour, remove your instrument to the other side and plant it at E, observing the bearing of the line EF, measuring its distance, together with that of the perpendicular *g*, in all respects as before; as also the lines FG, GH, HI, and their perpendiculars *hik*, continuing the perpendicular *h* to the end of a ledge of rocks lying off that point.

11. Because the cleft will interrupt your sight from the church at O, therefore you must place your instrument on the top of the cleft at *q*, and take the bearing of the church, and either measure the distance from your instrument to it, or else remove your instrument thither, and, having placed signals at *q* and *s*, take the angle *q* O *s*.

12. Remove your instrument at low-water to the sand at X, taking the bearings, and measuring the distances of the lines X*l* and *l r*, together with the perpendiculars *m*, *n*, *o*.

Having finished your observations, proceed to construct your map in the following manner:

1, Draw the east and west line BC, setting off on it the several distances, viz. from A to R, A to *a*, &c. then by drawing the several perpendiculars, and making them of their proper lengths, you may easily draw the track of the surface of the water, and those which are above the line will give the places where the several objects are to be delineated.

2. By the help of your protractor or line of chords, make the several angles at A, and R, equal to their respective number of degrees, &c. drawing a right-line through each, which continue at pleasure.

3. Construct the angles at B in the same manner, continuing the right-lines from this station till they cut those projected from A and R, which will be the true places of those objects; whence the sands Q, Y, and Z, may be easily drawn.

4. By projecting the angle ABM, and setting off on the line BM its proper distance, you will have the place where that church must be delineated.

5. Construct the angles BCD and DCE, continuing the line CE at pleasure, and set off its proper length on the line CD; then by drawing the perpendicular *f* of its proper length, you may draw that part of the harbour between C and D.

6. Construct the angle at D, continuing the line DE till it cuts CE in E, which will give the place of the station at E.

7. By constructing the angles ABK, ABL, BMK, and KML; and continuing the lines BK, BL, MK, and ML, till they cut each other in K and L; you will have the situation of the objects at K and L.

8. Proceed in the same manner on the other side of the harbour, by projecting the lines EF, FG, GH, and HI, according to their several bearings, &c. and by drawing the several perpendiculars of their true length, the track of the surface of the water on the east side of the harbour may be delineated; also, by continuing the perpendicular *h*, you will have the situation of the ledge of rocks lying off that point.

9. Observe to draw the appearance of the land; that is, from A to *d*, the sand-hills which lie along above the high-water mark, and the cleft which stretches all along the east side of the harbour.

10. In some convenient place draw the compass, but let it be in its true position without any variation; that is, observe to allow for the variation, if any, which must also be done before you begin your projection.

11. Draw the lines Q*t*K, QPM, *z w* O, *y*PL, and ZPK, which will shew the marks necessary to be observed by ships in coming into the harbour.

12. At low-water go off in your boat, and sound the depth of the water in various places, which insert in your map; and observe the setting of the tide, which you must represent by darts. Also the time of high water at the full and change of the moon must be inserted in Roman numbers.

13. Lastly, in some convenient place of your map insert a scale, of the same length of that which you made use of in the projection.

SURVEYOR, one that hath the oversight and care of considerable works, lands, or the like.

Such are the surveyor-general of the king's manors, surveyor of the king's exchange, surveyor-general of the works, surveyor-general of the crown lands, &c.

SURVEYOR *of the Melting*, is an officer of the mint, whose office is to see the bullion cast out, and that it be not altered after the delivery of it to the melter.

SURVEYOR *of the Navy*, an officer whose business is to know the state of all stores, and see the wants supplied; to survey the hull, masts, and yards of ships; to audit the boatswains and carpenters accounts, &c.

SURVEYOR *of the Ordnance*, is an officer whose charge is to survey all the king's ordnance, stores, and provisions of war, in custody of the store-keeper of the Tower of London; to allow all bills of debts, to keep checks on labourers and artificers work, &c.

SURVEYOR, is also used for a gauger. And also for a person who measures and makes maps of land.

SUSPENSION, in mechanics, are those points in the axis or beam of a ballance, wherein the weights are applied, or from which they are suspended.

SUSPENSION *of Arms*, in war, is a short truce which the contending parties agree on, for the burial of their dead, the waiting for succours, or the order of their masters, &c.

SUSPENSION, in rhetoric, is the carrying on a period or discourse, in such a manner as to keep the reader in expectation of something considerable in the conclusion. But great care must be taken, that the reader's expectation be not disappointed; for nothing is more contemptible, than to promise much and perform little, or to usher in an arrant trifle with the formality of preface, and solemn preparation.

SUSPENSOR, in anatomy, the same with the cremaster muscle. See CREMASTER.

SUSPICION, in law. Persons may be taken up upon suspicion, where a felony is committed, &c. however, there must be at least some reasonable grounds for the same.

SUSPIRAL, a spring of water passing under ground towards a conduit or cistern. Also a breathing hole or ventiduct.

SUSSEX *Marble*, a name given by many to a peculiar species of marble found in the county, the name of which it bears, and formerly much used in the pillars of churches, and other buildings, but now less in esteem. The ground of this marble is grey, with a faint cast of green, and it is very thick set in all parts with shells: these are chiefly of the turbinated kind, and they are generally filled with a white spar, which adds very greatly to the beauty of the stone.

It is plain, from conſidering the whole maſs of this marble, that this ſpar was received into the ſhells before they were depoſited in the marble. This is about the hardneſs of the common white Genoeſe marble, if any thing, ſomewhat more hard. The ſlender round ſcapi of the pillars in Weſtminſter-Abbey, and in many other of our Gothic buildings, are made of this kind of marble. Some people have thought that the ſcapi of pillars of this kind, which occur in moſt of our Gothic buildings, are artificial, and that they are a kind of fuſile marble caſt in cylindric moulds. But any one who will compare the marble, of which thoſe pillars are made, with its ſhells, and the ſpar they are filled with, with the marble of Suſſex quarries, will find both to be the ſame in every particular. *Woodward's Cat. of Foſſ.*

SUTURE, *Sutura*, in anatomy, is a particular articulation. The bones of the cranium are joined to one another by four ſutures. The firſt is called the coronalis. It reaches tranſverſely from one temple to the other. It joins the os frontis to the oſſa parietalia and petroſa. The ſecond is called lambdoidalis, becauſe it reſembles the Greek letter (Λ) lambda. It joins the os occipitis to the oſſa parietalia and petroſa. The third is called ſagittalis; it begins at the top of the lambdoidalis, and runs ſtraight to the middle of the coronalis. It joins the two oſſa parietalia together. The fourth is called ſutura ſquamoſa, becauſe the parts of theſe bones which are joined by this ſuture, are as it were cut ſlopewiſe and lapped over one another.

This ſuture joins the ſemicircular circumference of the oſſa temporum to the os ſphenoides occipitis, and to the oſſa parietalia. The firſt three ſutures were called ſuturæ veræ; and the laſt ſutura falſa, becauſe it was ſuppoſed to have no indentations, which is falſe.

The bones of the cranium are not only joined to one another, but they are alſo joined to the bones of the upper jaw by three other ſutures. The firſt is the tranſverſalis; it runs acroſs the face, it paſſes from the little angle of the eye, down to the bottom of the orbit, and up again by the great angle of the eye, over the root of the noſe, and ſo to the little angle of the other eye. It joins the os frontis to the bones of the upper jaw. The ſecond is the ethmoidalis; it ſurrounds the bone of that name, and joins it to the bones which are about it. The third is the ſutura ſphenoidalis; it ſurrounds the os ſphenoides, joins it to the os occipitis, the oſſa petroſa, and the os frontis.

SUTURE, in chirurgery, denotes a ſeam made to cloſe the lips of a wound, in order to its healing.

The ancients invented a great variety of ſutures, which they reduced to three kinds; incarnatives, reſtrictives, and conſervatives.

Incarnative SUTURE, is thus called, becauſe, by rejoining the edges of a wound, and keeping them together by means of a thread run acroſs them with a needle, they grow together, and incarnate as before.

This they ſubdivided into five kinds, viz. the 'interrupted, intertwiſted, pinned, or feathered, with claſps, and the dry ſuture.'

Of theſe five, two are perfectly diſuſed, viz. the feathered ſuture, and the ſuture with claſps, as being too barbarous, and at the ſame unneceſſary. The firſt was called pinned, when little pins were made uſe of; and feathered, when the barrels of feathers or quills were uſed.

To perform it, two or three needles, threaded with a double thread, were paſſed through the lips of the wound at a finger's breadth from each other, and a pin or feather put in the ſtitch; and another pin or feather bound with the ends of the ſame thread, that the feathers might keep the lips of the wound cloſe together.

To perform the ſecond, they had large, crooked claſps, pointed at each end; one of which they thruſt into the upper part of the wound, the other into the lower, to bring the lips together. Theſe ſutures, cruel as they were, are yet known to be uſeleſs; for in the only caſes where they ſhould ſeem ſerviceable, viz. in deep wounds, where the contraction of the fleſhy parts keeps the lips far aſunder, and in wounds of tendons; they expoſe the patient to terrible convulſions and ſhudderings, which are avoided, by diminiſhing the dilatation of the wounds, by moderate compreſſions, and waiting till the fibres relax.

Reſtrictive SUTURES, were thoſe wherewith they endeavoured to ſtop the flux of blood from large wounds, where any conſiderable veſſels were cut.

To this end, they invented ſeveral kinds, in the number whereof, were the ſhoe-makers, taylors, ſkinners, and other ſeams, each more impertinent than other. It is evident, the very deſign of ſuch a ſuture is blameable: for ſuppoſing the wound ſo exactly ſewed up, that no blood could eſcape through the lips thereof; yet will it ſtill flow out of the veſſels, and will thus be forced to make its way between the laminæ of the muſcles, by which means the part will ſwell, rot, and gangrene. Yet, the ſkinners ſuture, ſutura pellionum, is ſtill in uſe for wounds of the inteſtines: it is thus called, becauſe the ſkinners uſe the like, in ſewing up the holes made by the butchers, in flaying off the ſkin.

Conſervative SUTURE, is that kind of ancient ſuture, whereby the lips of large wounds, wherein there was a loſs of ſubſtance, were prevented from receding too far. But a bandage, now, ſuffices.

Intertwiſted SUTURE, is thus called, becauſe, the needles being left ſticking in the wound, the thread is wound around them; much after the ſame manner as the taylors do the threaded needles they keep in their ſleeves, &c. This ſuture is performed two ways; for either the needles are paſſed a-croſs the wound, or they are ſtuck on the ſides thereof.

All the ſutures, hitherto mentioned, are made with needle and thread: beſides which, there is another kind called dry ſutures, which are performed with glue or ſize, or other proper viſcous matter.

The dry SUTURE, is ordinarily made with ſmall pieces of leather, on linen cloth, indented like a ſaw, ſo that the teeth may fall between each other, and the whole row may be cloſed. The cloth, before it is cut into this form, is ſpread with ſome proper plaiſter, in order to its firm adheſion.

The plaiſters thus prepared, being cut into the form, are applied on the firm fleſh, according to the length of the wound, reaching from it to the diſtance of ſome inches; and after they are dried, or well faſtened to the part, the lips of the wound being approached, they may conveniently be held together by the ſuture in that poſture.

This kind of ſuture is principally uſed for wounds in the face, to prevent unſightly ſcars: it is likewiſe convenient when the fibres of the muſcles are cut a-croſs, and where it is difficult or impoſſible to apply a bandage.

In the other kinds of ſutures, the ſtitches ought always to be taken of a depth proportionable to that of the wound; care being had to avoid the nerves as much as poſſible. In long wounds they are beſt begun at the ends, but in ſhort ones at the middle.

SWALLOW'S TAIL, in fortification, a kind of outwork, only differing from a ſingle tenaille, in that its ſides are not parallel as thoſe of the tenaille, but narrower towards the fortified place, than towards the country.

SWALLOW'S TAIL, in carpentry and joinery, denotes a peculiar way of faſtening together two pieces of timber ſo ſtrongly as they cannot fall aſunder. See DOVE-TAILING.

SWARDY, in agriculture, an appellation given to lands well covered with graſs.

SWARM *of Bees*, in what manner hived, ſee the article HIVING.

The ſignal of the going out of a ſwarm from a hive is ſometimes only by a humming noiſe made by one ſingle bee, but that a very particularly acute and clear ſound: this ſeems to be the voice of the new queen or female bee, calling together the ſwarm that is to follow her out, and animating them with a ſort of martial muſic for the great adventure they are going to engage in.

Some who have pretended to be extremely well verſed in the language of the bees, as Butler, and others, ſay, that this is a voice of intreaty, by which the young queen begs permiſſion of the old queen, or parent of the hive, to take out a ſwarm with her to ſome other place: they ſay this noiſe of intreaty uſually laſts about two days,

and that, at the end of that time, if the parent grants the requeſt, ſhe is heard to anſwer with a louder and clearer voice of the ſame kind. Theſe noiſes are not to be heard, unleſs the ear be applied cloſe to the place; and they ſay, that when this laſt ſound is made, the new ſwarm may be expected certainly to go out the next day, if the weather be proper.

But he ſeems to have taken great pains to diſtinguiſh theſe ſounds; he gives all the modulations of the voice of the young female, and every note that ſhe runs into; and obſerves, that all theſe are notes of ſupplication, and that the ſounds iſſued by the parent, or reigning queen of the hive, have an air of majeſty, and are greatly different; and adds, that, if the young female attempts to make the ſounds of the reigning bee, it is looked upon as a rebellion in the hive; and he pretends to be acquainted with the proceedings againſt her in theſe caſes; he ſays ſhe loſes her head; and that ſeveral of the bees that followed her are treated in the ſame manner for having been ſeduced to a rebellion. *Reaumur's Hiſt. Inſect.*

If a hive has been very well peopled during the winter, the young progeny go out early in the ſpring; and, if it have been very thinly peopled, it is ſometimes as late as the middle of June before they go out, even without any accidental delay from the want of a queen.

The people who manage bees, are informed of the time when they are going to ſend out new ſwarms by ſeveral ſigns. One is, when the hive is ſo peopled, that many of the bees cannot find room within, but ſtand in cluſters on the outſide of the hive; another, is the appearance of a large number of drones, or male bees; theſe, however, are not certain ſigns, nor do they point out the very day of the ſwarming; but there is one which declares it very punctually, which is the obſerving, that though the hive be very full, and the day very fine, yet very few bees go out in ſearch of honey; in this caſe it is a certainty that they are aſſembling themſelves in the hive, and preparing to be gone in a very little time. If a perſon go near the hives that are ready to ſend out ſwarms, in the evening, or even in the night, he will hear a ſort of a humming noiſe in them, which is not to be heard at ſuch times on any other occaſion: in ſhort, the whole is in agitation on the occaſion, and the tumult never ceaſes till the new colony goes out.

SWATH, *Faſcia*, in ſurgery, a long and broad bandage, for binding up any diſordered limb. See BANDAGE.

SWEAT, *Sudor*, a ſenſible moiſture iſſuing out of the pores of the ſkins of animals, through too much heat, exerciſe, or weakneſs; or through the action of certain medicines called ſudorifics. Under the ſkin above the fat are diſpoſed all over the body what we call the miliary glands, which are cloſely united, each gland furniſhed with an artery, vein, and nerve, and produce an excretory duct or veſſel, which paſſes through a perforation in the reticular body, and diſcharges, through a wide orifice, the ſweat under the epidermis. Theſe ducts are covered with a hollow and raiſed valve of a round figure, and ſeated under the ſkin; its uſe is to tranſmit or reſtrain the humour. This excretory duct is the principal organ of ſweat, in conjunction with the vaſcula Ruycheiana.

The ſweat thus ſecreted varies according to the differences of air, ſoil, ſex, age, temperament, emunctories, diet, way of living, and time of concoction, almoſt in the ſame manner as does the urine.

Sweat is ſeldom or never obſerved in a ſound body, unleſs from an error of the non-naturals; in its primary effects it is always hurtful, by accident it ſometimes proves beneficial. See PERSPIRATION.

SWEATING-SICKNESS. See the article SUDOR ANGLICANUS.

SWEATING-HOUSE. The natives of North-America, when we firſt ſettled among them, had a great many houſes to ſweat in, it being their general remedy for diſeaſes of whatever kind; but at preſent they are leſs uſed among them.

The cave, or ſweating-houſe, was uſually eight feet in diameter, and four feet high, the roof being ſupported by ſticks or boards. They uſually dug theſe caves in the ſide of a hill, and as near as could be to ſome river, or pond. The entrance into the cave was ſmall, and, when any perſon was ſweating in it, the door was covered with a blanket, or ſkin. Near the cave they uſed to make a large fire, and heat in this a quantity of ſtones, perhaps five hundred weight; theſe they rolled into the cave, and piled up in a heap in the middle. When this is done, the Indians go in naked, as many as pleaſe, and ſit round the heap of ſtones; and as ſoon as they begin to grow faint, which is uſually in a quarter of an hour, they come out, and plunge themſelves all over in the water, remaining in it a minute or two; and, repeating this a ſecond time, they dreſs themſelves, and go about their buſineſs.

This has been uſed for many ages among them with ſucceſs, in caſe of colds, ſurfeits, ſciaticas, and pains fixed in their limbs; and the Engliſh have often uſed the ſame means, and found relief by it. It is practiſed equally at all times of the year, and the Indians do it not only in ſickneſſes, but by way of refreſhment after long journies, and other fatigues, and ſo ſtrengthen themſelves for any expeditions. *Philoſ. Tranſ.* N°. 384.

SWEET, in the wine trade, denotes any vegetable juice, whether obtained by means of ſugar, raiſins, or other foreign or domeſtic fruit, which is added to wines, with a deſign to improve them. It is plain, ſays Dr. Shaw, from the making of artificial muſt, or ſtum, by means of fine ſugar, with a ſmall addition of tartar, that the art of ſweet-making might receive a high degree of improvement, by the uſing pure ſugar, as one general wholeſome ſweet, inſtead of thoſe infinite mixtures of honey, raiſins, ſyrups, treacle, ſtum, cyder, &c. wherewith the ſweet-makers ſupply the wine-coopers, to lengthen out or amend their wines: for pure ſugar being added to any poor wine, will ferment therewith, and improve it, and bring it to a proper degree of ſtrength and vinoſity. If the wine that is to be amended is tart of itſelf, no tartar ſhould be added to the ſugar; but if it be too ſweet and luſcious, then the addition of tartar is neceſſary.

SWEET-SUBLIMATE *of mercury*, the ſame with mercurius dulcis. See MERCURY and CALOMEL.

SWELLING, in ſurgery. See the articles INFLAMMATION and TUMOUR.

SWIMMING, the art or act of ſuſtaining the body in water, and of moving therein; in which action the air-bladder and fins of fiſhes bear a conſiderable part.

Some have ſuppoſed, that the motion of fiſh in the water, depends principally upon the pectoral fins, but the contrary is eaſily proved by experiment; for if the pectoral fins of a fiſh are cut off, it will be found to move forward or ſide-ways, upward or downward, as well as it did when it had them on. If a fiſh be carefully obſerved, while ſwimming in a baſon of clear water, it will be found not to keep theſe pectoral fins conſtantly expanded, but only to open them at ſuch times as it would ſtop or change its courſe; this ſeeming to be their principal, if not their only uſe. The pectoral and ventral fins, in the common fiſhes of a compreſſed form, ſerve in the ſame manner in keeping the fiſh ſtill, and ſerve in ſcarce any other motion than that towards the bottom: ſo that this motion of the fiſh, which has been generally attributed to their fins, is almoſt wholly owing to their muſcles, and the equipoiſe of their air-bladder. That the uſe of the pectoral and ventral fins is to keep the fiſh ſteady and upright in the water, is evident from the conſequences of their loſs: if they are cut off, and the fiſh put again into the water, it cannot continue in its natural erect poſture, but ſtaggers about and rolls from ſide to ſide. The fins of the back and anus are alſo of great uſe to the keeping the creature in its natural poſition, as is eaſily ſeen by cutting them off, and obſerving the motions of the fiſh afterwards.

Though a great deal depends on the motion of the muſcles of the ſeveral parts of the body, in the ſwimming of the fiſh, yet the tail, and thoſe muſcles which move the lower part of the body, to which it is affixed, are the great inſtruments by which their ſwift motions in the water are performed. The moving the tail, and that part of the body to which it adheres, backward and forward, or ſideways any one way, throws the whole

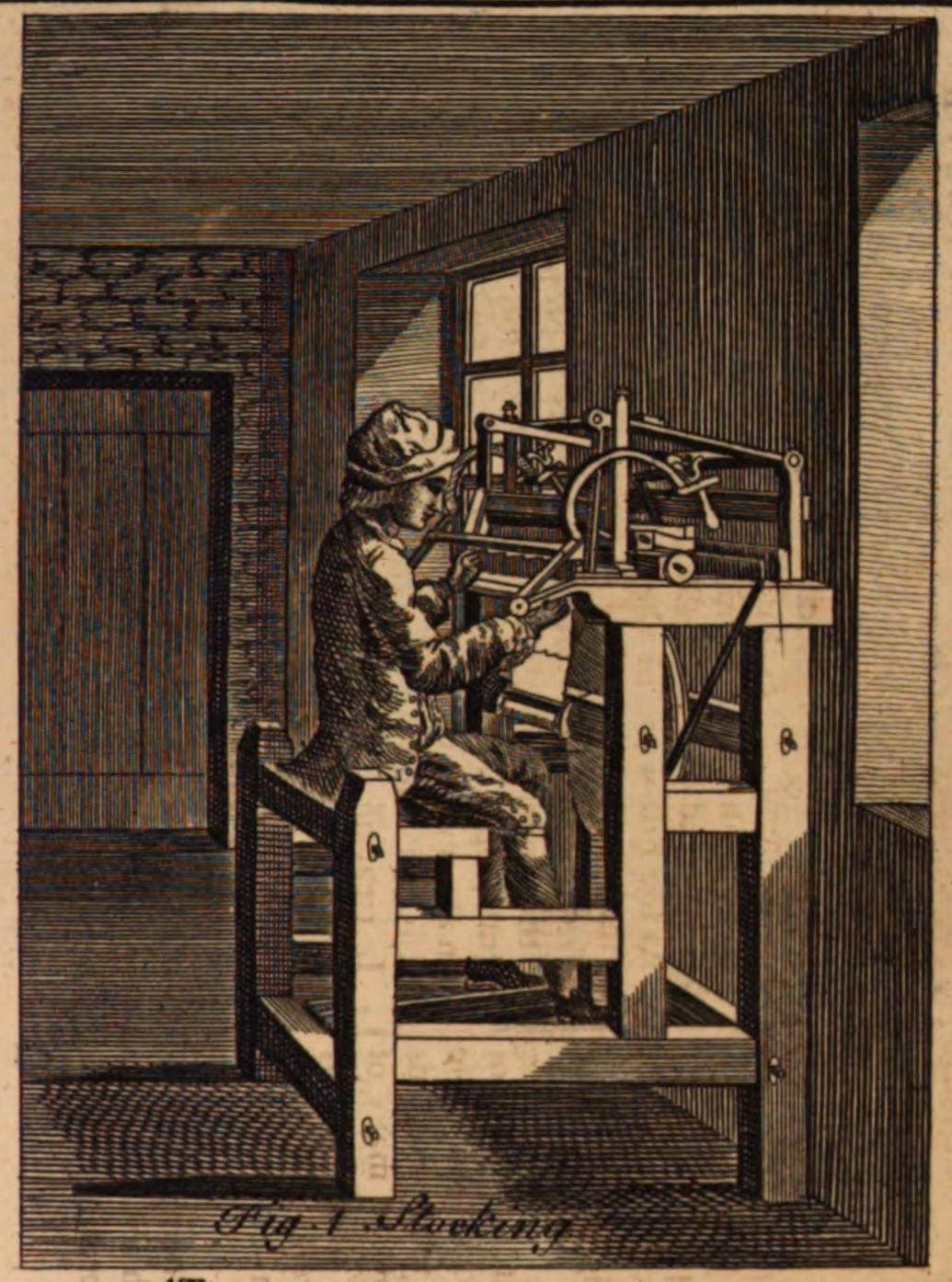


Fig. 1 Rocking.

Fig. 2. Subnormal.

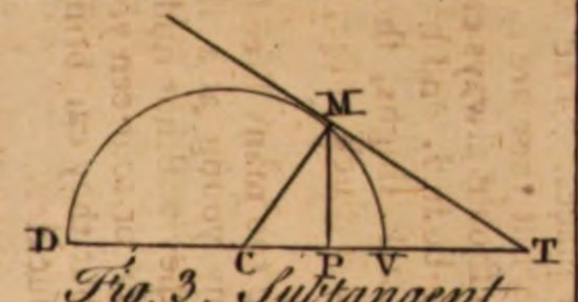


Fig. 3. Subtangent.

Fig. 4.

Fig. 6. Swimming.

Fig 7.

whole body of the fiſh ſtrongly the contrary way; and even in ſwimming ſtraight forward, the motion and direction are both greatly aſſiſted by the vibrations of this part, as may be experienced in the motion of a boat, which, when impelled forward, may be firmly guided by means of an oar held out at its ſtern, and moved in the water as occaſion directs. The dorſal muſcles, and thoſe of the lower part of the body between the anus and tail, are the principal that are uſed in the motion of this part, and theſe are therefore the moſt uſeful to the fiſh in ſwimming. The muſcles of the belly ſeem to have their principal uſe in the contracting the belly and the air-bladder. They have been ſuppoſed of uſe to move the belly-fins; but there are too many of them for ſuch a purpoſe, and theſe fins have each its peculiar muſcle fully ſufficient to the buſineſs. The uſe of the tail in ſwimming is eaſily ſeen, by cutting it off, and committing the fiſh to the water without it, in which caſe it is a moſt helpleſs creature.

Let A B (plate CXXIII. *fig.* 6.) be a fiſh ſwimming: by expanding or contracting its air-bladder L, it can riſe or ſink in the water at pleaſure; and its direct motion is performed by means of its tail B C D, vibrating from one ſide to another, which is performed thus; ſuppoſe the tail in the poſition F G, (*fig.* 7.) being about to be moved ſucceſſively to H, I, and K; the fiſh firſt turns the end G, oblique to the water, and moves it quickly towards K; the reſiſtance of the water, acting in the mean time obliquely, moves him partly forward and partly ſideways; but this lateral motion is corrected by the next ſtroke, from K towards I, K, and G; which is performed by turning the tail obliquely the contrary way to what it was in the firſt ſtroke. By the help of the tail they alſo turn about, by ſtriking ſtrongly with it on one ſide, and keeping it bent, ſo as to act like the rudder of a ſhip. The fins, eſpecially the pectoral ones E, E, ſerve to keep the fiſh upright, as alſo to aſcend and deſcend.

Brutes ſwim naturally, but men attain this art by practice and induſtry: it conſiſts principally in ſtriking alternately with the hands and feet; which, like oars, row a perſon forward: he muſt keep his body a little oblique, that he may the more eaſily erect his head, and keep his mouth above water.

SWINE, in zoology, a general name for the ſus or hog-kind. See Hog.

Swine are very profitable creatures to the owner, being kept at ſmall expence, feeding on things that would be otherwiſe thrown away, and producing a very large increaſe. They are apt to dig up the ground, and to break fences; but this may be prevented, by putting rings in their noſes, and yokes about their necks. Leiceſterſhire, Northamptonſhire, and Hampſhire, are famous for theſe animals, which ſeems owing to their being clayey countries, and that more beans and peaſe are ſown there, than in other places. The wild kind never grow ſo large as the tame, but they are much better taſted. The keepers of hogs ſhould always chuſe ſuch boars to breed out of as are long-bodied, and have deep bellies and ſides, ſhort noſes, thick thighs, ſhort legs, high claws, a thick neck, and a thick chine, well ſet with large briſtles.

It is not proper to keep too many breeding ſows; for they will produce ſo many young at a time, and this three times a year, that they will not find food enough. They uſually bring thirteen or fourteen young ones in a litter, ſometimes more; but they can bring up no more than they have teats to ſuckle.

Young ſhoots, as they are called, that is, ſwine of three quarters of a year old, are beſt for pork, and thoſe of a year and half, for bacon. Moiſt and ſedgy grounds are good for ſwine, for they eat the roots of many of the plants that grow there; and the fruit of the beech, cheſnut, and hedgebuſhes, fatten them well, and make their fleſh much better taſted, than when bred intirely in the ſtye. *Mortimer's Husbandry.*

SWINGLING, the beating of flax, or hemp, after it has been well broken with the brake: this is done by taking up the flax in handfuls, and then beating it with a rod, or a flatted and ſmooth ſtick, in order to free it from the bun, and prepare it for being heckled.

SWITZERLAND, or Swisserland, called Helvetia by the Romans, is bounded by the Suntgow, the Hircinian foreſt, and other parts of Swabia, on the north; by the lake of Conſtance, alſo Tyrol and Trent, on the eaſt; by Savoy, Milan, and other provinces of Italy, on the ſouth; and by Burgundy and Franche-Comté on the weſt. It is about two hundred and ſixty miles long, and upwards of a hundred broad; ſome parts of Italy and France being now included in it, which did not belong to the ancient Helvetii.

There are thirteen provinces or cantons in this country.

SWOONING, in medicine, a ſpecies of lipothymy, wherein the patient is deprived of all ſenſe and motion. See Lypothymia.

SWORD, *Gladius*, an offenſive weapon worn at the ſide, and ſerving either to cut or ſtab; its parts are the handle, guard, and blade; to which may be added the bow, ſcabbard, pummel, &c. Fencing-maſters, however, divide the ſword into the upper, middle, and lower part; or the ſort, middle, and foible. See the article Fencing.

SYCAMORE-Tree, in botany, the Engliſh name of the acer major, or greater maple. See the article Maple.

SYCOPHANT, *συκοφαντης*, a Greek term originally uſed at Athens for perſons who made it their buſineſs to inform againſt thoſe who ſtole figs, or againſt thoſe, who, contrary to the law, which prohibited the exportation of them, practiſed the thing, and deceived the officers, the inſpectors of the ports, &c.

The word is formed from *συκον*, a fig, and *φαινω*, *indico*, to ſhew, or diſcover. At length the term became uſed in the general for all informers, tale-bearers, paraſites, flatterers, &c. eſpecially thoſe in the courts of princes: and at laſt for lyars, impoſtors, &c.

SYLLABLE, in grammar, a part of a word conſiſting of one or more letters which are pronounced together.

The word is derived from the Greek, *συλλαβη*, which literally denotes comprehenſion, or aſſemblage.

Or ſyllable is a complete word, uttered in one breath, conſiſting either of a vowel alone, or of a vowel and one or more conſonants, not exceeding ſeven.

SYLLABUB, a compound liquor made of white wine and ſugar, into which is put new milk. If cream be uſed inſtead of milk, it is called whipt ſyllabub.

SYLLABUS, in matters of literature, denotes a table of contents, or an index of the chief heads of a book or diſcourſe.

SYLLEPSIS, in Latin and Greek grammar, a figure whereby we conceive the ſenſe of words otherwiſe than the words import; and thus make our conſtruction, not according to the words, but the intention of the author.

It is alſo uſed for the agreement of a verb or adjective, not with that word next it, but with the moſt worthy in the ſentence, as *rex et regina beati.*

SYLLOGISM, in logic, an argument, or form of reaſoning, conſiſting of three propoſitions; having this property, that the concluſion neceſſarily follows from the two premiſes: ſo that if the firſt and ſecond propoſition be granted, the concluſion muſt be granted in like manner, and the whole allowed for a demonſtration.

As the firſt work of the mind is perception, whereby our ideas are framed, and the ſecond is judgment, which joins or disjoins our ideas, and forms a propoſition, ſo the third operation of the mind is reaſoning, which joins ſeveral propoſitions together, and makes a ſyllogiſm, that is an argument whereby we are wont to infer ſomething that is leſs known, from truths which are more evident.

In treating of this ſubject, let us conſider more particularly, 1. The nature of a ſyllogiſm, and the parts of which it is compoſed. 2. The ſeveral kinds of ſyllogiſms, with particular rules relating to them. 3. The doctrine of ſophiſms, or falſe reaſoning, together with the means of avoiding them, and the manner of ſolving or anſwering them. 4. Some general rules to direct our reaſoning.

If

If the mere perception and compariſon of two ideas would always ſhew us whether they agree or diſagree; then all rational propoſitions would be matters of intelligence, or firſt principles, and there would be no uſe of reaſoning or drawing any conſequences. It is the narrowneſs of the human mind which introduces the neceſſity of reaſoning. When we are unable to judge of the truth or falſhood of a propoſition in an immediate manner, by the mere contemplation of its ſubject and predicate, we are then conſtrained to uſe a medium, and to compare each of them with ſome third idea, that by ſeeing how far they agree or diſagree with it, we may be able to judge how far they agree or diſagree among themſelves: as, if there are two lines, A and B, and we know not whether they are equal or no, we take a third line C, or an inch, and apply it to each of them; if it agree with them both, then we infer that A and B are equal; but if it agree with one and not with the other, then we conclude A and B are not equal: if it agree with neither of them, there can be no compariſon.

So if the queſtion be, whether God muſt be worſhipped, we ſeek a third idea, ſuppoſe the idea of a Creator, and ſay, "Our Creator muſt be worſhipped; God is our creator; therefore God muſt be worſhipped." The compariſon of this third idea with the two diſtinct parts of the queſtion, uſually requires two propoſitions, which are called the premiſes: the third propoſition which is drawn from them is the concluſion, wherein the queſtion itſelf is anſwered, and the ſubject and predicate joined either in the negative or the affirmative.

The foundation of all affirmative concluſions is laid in this general truth, that ſo far as two propoſed ideas agree to any third idea, they agree alſo among themſelves. The character of creator agrees to God, and worſhip agrees to a creator, therefore worſhip agrees to God.

The foundation of all negative concluſions is this, that where one of the two propoſed ideas agrees with the third idea, and the other diſagrees with it, they muſt needs diſagree ſo far alſo with one another; as, if *no ſinners are happy*, and if *angels are happy*, then *angels are not ſinners*.

Thus it appears what is the ſtrict and juſt notion of a ſyllogiſm: it is a ſentence or argument made up of three propoſitions ſo diſpoſed, as that the laſt is neceſſarily inferred from thoſe which go before, as in the inſtances which have been juſt mentioned.

In the conſtitution of a ſyllogiſm two things may be conſidered, viz. the matter and the form of it. The matter of which a ſyllogiſm is made up, is three propoſitions; and theſe three propoſitions are made up of three ideas or terms variouſly joined. The three terms are called the remote matter of a ſyllogiſm; and the three propoſitions the proximate or immediate matter of it.

The three terms are named the major, the minor, and the middle. The predicate of the concluſion is called the major term, becauſe it is generally of a larger extenſion than the minor term, or the ſubject. The major and minor terms are called the extremes. The middle term is the third idea invented and diſpoſed in two propoſitions in ſuch a manner as to ſhew the connexion between the major and minor term in the concluſion; for which reaſon the middle term itſelf is ſometimes called the argument. That propoſition which contains the predicate of the concluſion connected with the middle term, is uſually called the major propoſition, whereas the minor propoſition connects the middle term with the ſubject of the concluſion, and is ſometimes called the aſſumption.

Note, This exact diſtinction of the ſeveral parts of a ſyllogiſm, and of the major and minor terms connected with the middle term, in the major and minor propoſitions, does chiefly belong to ſimple or categorical ſyllogiſms, though all ſyllogiſms whatever have ſomething analogical to it.

Note farther, that the major propoſition is generally placed firſt, and the minor ſecond, and the concluſion in the laſt place, where the ſyllogiſm is regularly compoſed and repreſented.

The form of a ſyllogiſm is the framing and diſpoſing of the premiſes according to art, or juſt principles of reaſoning, and the regular inference of the concluſion from them.

The *act of reaſoning*, or inferring one thing from another, is generally expreſſed and known by the particle *therefore*, when the argument is formed according to the rules of art; though in common diſcourſe or writing, ſuch *cauſal* particles as *for*, *becauſe*, manifeſt the act of reaſoning as well as the *illative* particles *then* and *therefore*: and whereſoever any of theſe words are uſed, there is a perfect ſyllogiſm expreſſed or implied, though perhaps the three propoſitions do not appear, or are not placed in regular form.

Syllogiſms are divided into various kinds, either according to the queſtion which is proved by them, according to the nature and compoſition of them, or according to the middle term, which is uſed to prove the queſtion. According to the queſtion which is to be proved, ſo ſyllogiſms are divided into univerſal affirmative, univerſal negative, particular affirmative, and particular negative. This is often called a diviſion of ſyllogiſms drawn from the concluſion; for ſo many ſorts of concluſions there may be which are marked with the letter A, E, I, O.

In an univerſal affirmative ſyllogiſm, one idea is proved univerſally to agree with another, and may be univerſally affirmed of it, as "Every ſin deſerves death; every unlawful wiſh is a ſin; therefore every unlawful wiſh deſerves death."

In an univerſal negative ſyllogiſm, one idea is proved to diſagree with another idea univerſally, and may be thus denied of it: "As no injuſtice can be pleaſing to God, all perſecution for the ſake of conſcience is injuſtice; therefore no perſecution for conſcience ſake can be pleaſing to God."

Particular affirmative, and particular negative ſyllogiſms may be eaſily underſtood by what is ſaid of univerſals, and there will be ſufficient examples given of all theſe hereafter.

The general principle upon which theſe univerſal and particular ſyllogiſms are founded is this, whatſoever is affirmed or denied univerſally of any idea, may be affirmed or denied of all the particular kinds or beings, which are contained in the extenſion of that univerſal idea. So the deſert of death is affirmed univerſally of ſin, and an unlawful wiſh is one particular kind of ſin, which is contained in the univerſal idea of ſin, therefore the deſert of death may be affirmed concerning an unlawful wiſh. And ſo of the reſt.

The next diviſion of ſyllogiſms is into ſingle and compound. This is drawn from the nature and compoſition of them. Single ſyllogiſms are made up of three propoſitions; compound ſyllogiſms contain more than three propoſitions, and may be formed into two or more ſyllogiſms.

Single ſyllogiſms, for diſtinction's ſake, may be divided into ſimple, complex, and conjunctive. Theſe are properly called ſimple or categorical ſyllogiſms, which are made up of three plain, ſingle, or categorical propoſitions, wherein the middle term is evidently and regularly joined with one part of the queſtion in the major propoſition, and with the other in the minor, whence there follows a plain ſingle concluſion; as, "Every human virtue is to be ſought with diligence; prudence is a human virtue; therefore prudence is to be ſought diligently."

Though the terms of propoſitions may be complex; yet where the compoſition of the whole argument is thus plain, ſimple, and regular, it is properly called a ſimple ſyllogiſm, ſince the complexion does not belong to the ſyllogiſtic form of it.

Simple ſyllogiſms have ſeveral rules belonging to them, which being obſerved, will generally ſecure us from falſe inferences: but theſe rules being founded on four general axioms, it is neceſſary to mention theſe axioms before-hand, for the uſe of thoſe who will enter into the ſpeculative reaſon of all theſe rules. 1. Particular propoſitions are contained in univerſals, and may be inferred from them; but univerſals are not contained in particulars, nor can be inferred from them. 2. In all univerſal propoſitions, the ſubject is univerſal: in all particular propoſitions the ſubject is particular. 3. In all affirmative propoſitions, the predicate has no greater extenſion than the ſubject; for its extenſion is reſtrained by the ſubject, and therefore it is always to be eſteemed

as a particular idea. It is by mere accident, if it ever be taken univerſally, and cannot happen but in ſuch univerſal or ſingular propoſitions as are reciprocal. 4. The predicate of a negative propoſition is always taken univerſally, for in its whole extenſion it is denied of the ſubject. If we ſay *no ſtone is vegetable*, we deny all ſorts of vegetation concerning ſtones.

The rules of ſimple, reglar ſyllogiſms are theſe: 1. The middle term muſt not be taken twice particularly, but once at leaſt univerſally. For if the middle term be taken for two different parts or kinds of the ſame univerſal idea, then the ſubject of the concluſion is compared with one of theſe parts, and the predicate with another part, and this will never ſhew whether that ſubject and predicate agree or diſagree; there will then be four diſtinct terms in the ſyllogiſm, and the two parts of the queſtion will not be compared with the ſame third idea; as if we ſay, *ſome men are pious*, and *ſome men are robbers*, we can never infer that *ſome robbers are pious*, for the middle term men being taken twice particularly, it is not the ſame men who are ſpoken of in the major and minor propoſitions. 2. The terms in the concluſion muſt never be taken more univerſally than they are in the premiſes. The reaſon is derived from the firſt axiom, that generals can never be inferred from particulars. 3. A negative concluſion cannot be proved by two affirmative premiſes. For when the two terms of the concluſion are united or agree to the middle term, it does not follow by any means that they diſagree with one another. 4. If one of the premiſes be negative, the concluſion muſt be negative. For if the middle term be denied of either part of the concluſion, it may ſhew that the terms of the concluſion diſagree, but it can never ſhew that they agree. 5. If either of the premiſes be particular, the concluſion muſt be particular. This may be proved for the moſt part from the firſt axiom.

Theſe two laſt rules are ſometimes united in this ſingle ſentence. The concluſion always follows the weaker part of the premiſes. Now negatives and particulars are counted inferior to affirmatives and univerſals. 6. From two negative premiſes nothing can be concluded. For they ſeparate the middle term both from the ſubject and predicate of the concluſion, and when two ideas diſagree to a third, we cannot infer that they either agree or diſagree with each other.

Yet where the negation is a part of the middle term, the two premiſes may look like negatives according to the words, but one of them is affirmative in ſenſe: as, What has no thought cannot reaſon; but a worm has no thought; therefore a worm cannot reaſon. The minor propoſition does really affirm the middle term concerning the ſubject, viz. a worm is what has no thought, and thus it is properly in this ſyllogiſm an affirmative propoſition. 7. From two particular premiſes nothing can be concluded. This rule depends chiefly on the firſt axiom.

Simple ſyllogiſms are adorned and ſurrounded in the common books of logic with a variety of inventions about moods and figures, wherein by the artificial contexture of the letters A, E, I, and O, men have endeavoured to transform logic, or the art of reaſoning, into a ſort of mechaniſm, and to teach boys to ſyllogiſe, or frame arguments and refute them, without any real inward knowledge of the queſtion.

All the poſſible compoſitions of three of the letters, A, E, I, O, to make three propoſitions amount to ſixty-four; but fifty-four of them are excluded from forming true ſyllogiſms by the ſeven rules already mentioned: the remaining ten are variouſly diverſified by figures and moods into fourteen ſyllogiſms.

The figure of a ſyllogiſm is the proper diſpoſition of the middle term with the parts of the queſtion. A mood is the regular determination of propoſitions according to their quantity and quality, that is, their univerſal or particular affirmation or negation; which are ſignified by certain artificial words wherein the conſonants are neglected, and theſe four vowels A, E, I, O, are only regarded. There are generally reckoned three figures.

In the firſt of them the middle term is the ſubject of the major propoſition, and the predicate of the minor. This contains four moods, viz. Barbara, Celarent, Darii, Ferio. And it is the excellency of this figure that all ſorts of queſtions or concluſions may be proved by it, whether A, E, I, or O, that is, univerſal or particular, affirmative or negative, as,

Bar- Every wicked man is truly miſerable;
ba- All tyrants are wicked men;
ra. Therefore all tyrants are truly miſerable.

Ce- He that is always in fear is not happy;
la- Covetous men are always in fear;
rent. Therefore covetous men are not happy.

Da- Whatſoever furthers our ſalvation is good for us;
ri- Some afflictions further our ſalvation;
i. Therefore ſome afflictions are good for us;

Fe- Nothing that muſt be repented of is truly deſirable;
ri- Some pleaſures muſt be repented of;
o. Therefore there are ſome pleaſures which are not truly deſirable.

In the ſecond figure the middle term is the predicate of both the premiſes; this contains four moods, viz. Ceſare Cameſtres, Teſtino, Baroco, and it admits only of negative concluſions; as,

Ce- No liar is fit to be believed;
ſa- Every good Chriſtian is fit to be believed;
re. Therefore no good Chriſtian is a liar.

The reader may eaſily form examples of the reſt.

The third figure requires that the middle term be the ſubject of both the premiſes. It has ſix moods, viz. Darapti, Felapton, Diſamis, Datiſi, Bocardo, Feriſon; and it admits only of particular concluſions; as,

Da- Whoſoever loves God ſhall be ſaved;
rap- All the lovers of God have their imperfections:
ti. Therefore ſome who have imperfections ſhall be ſaved.

From what has been already ſaid, we ſhall leave the reader to form examples of the reſt.

Complex SYLLOGISMS. — It is not the mere uſe of complex terms in a ſyllogiſm that gives it this name, though one of the terms is uſually complex; but thoſe are properly called complex ſyllogiſms, in which the middle term is not connected with the whole ſubject, or the whole predicate in two diſtinct propoſitions, but is intermingled and compared with them by parts, or in a more confuſed manner, in different forms of ſpeech; as,

The ſun is a ſenſeleſs being;
The Perſians worſhipped the ſun;
Therefore the Perſians worſhipped a ſenſeleſs being.

Here the predicate of the concluſion is worſhipped a ſenſeleſs being, part of which is joined with the middle term ſun in the major propoſition, and the other part in the minor.

Though this ſort of argument is confeſſed to be entangled, or confuſed, and irregular, if examined by the rules of ſimple ſyllogiſms; yet there is a great variety of arguments uſed in books of learning, and in common life, whoſe conſequence is ſtrong and evident, and which muſt be ranked under this head; as,

1. Excluſive propoſitions will form a complex argument; as, "Pious men are the only favourites of heaven; true Chriſtians are favourites of heaven; therefore true Chriſtians are pious men." Or thus, "Hypocrites are not pious men; therefore hypocrites are no favourites of heaven."

2. Exceptive propoſitions will make ſuch complex ſyllogiſms; as, "None but phyſicians came to the conſultation; the nurſe is no phyſician; therefore the nurſe came not to the conſultation.

3. Comparative propoſitions; as, "Knowledge is better than riches; virtue is better than knowledge; therefore virtue is better than riches." Or thus, "A dove will fly a mile in a minute; a ſwallow flies ſwifter than a dove: therefore a ſwallow will fly more than a mile in a minute."

4. Inceptive and deſitive propoſitions; as, "The fogs vaniſh as the ſun riſes; but the fogs have not yet begun to vaniſh; therefore the ſun is not yet riſen."

5. Modal propoſitions; as, "It is neceſſary that a general underſtands the art of war; but Caius does not underſtand the art of war; therefore it is neceſſary Caius ſhould not be a general: Or thus, "A total

eclipſe of the ſun would cauſe darkneſs at noon; it is poſſible that the moon at that time may totally eclipſe the ſun; therefore it is poſſible that the moon may cauſe darkneſs at noon."

Beſide all theſe, there are a great number of complex ſyllogiſms which can hardly be reduced under any particular titles, becauſe the forms of human language are ſo exceeding various.

Conjunctive SYLLOGISM. Thoſe are called conjunctive ſyllogiſms, wherein one of the premiſes, namely the major, has diſtinct parts, which are joined by conjunction, or ſome ſuch particle of ſpeech. Moſt times the major or minor, or both, are explicitely compound propoſitions; and generally the major propoſition is made up of two diſtinct parts or propoſitions, in ſuch a manner, as that by the aſſertion of one in the minor, the other is either aſſerted or denied in the concluſion: or by the denial of one in the minor, the other is either aſſerted or denied in the concluſion. It is hardly poſſible indeed to fit any ſhort definition to include all the kinds of them; but the chief amongſt them are the conditional ſyllogiſm, the diſjunctive, the relative, and the connexive.

The conditional or hypothetical ſyllogiſm is whoſe major or minor, or both, are conditional propoſitions; as, "If there be a God, the world is governed by providence; but there is a God; therefore the world is governed by providence."

Theſe ſyllogiſms admit two ſorts of true argumentation, where the major is conditional.

1. When the antecedent is aſſerted in the minor, that the conſequent may be aſſerted in the concluſion; ſuch is the preceding example. This is called arguing from the poſition of the antecedent to the poſition of the conſequent.

2. When the conſequent is contradicted in the minor propoſition, that the antecedent may be contradicted in the concluſion; as, "If atheiſts are in the right, then the world exiſts without a cauſe, but the world does not exiſt without a cauſe; therefore atheiſts are not in the right." This is called arguing from the removing of the conſequent to the removing of the antecedent.

To remove the antecedent or conſequent here does not merely ſignify the denial of it, but the contradiction of it; for the mere denial of it by contrary propoſition will not make a true ſyllogiſm as appears thus: "If every creature be reaſonable, every brute is reaſonable: but no brute is reaſonable; therefore no creature is reaſonable." Whereas if you ſay in the minor, but "Every brute is not reaſonable," then it would follow truly in the concluſion, therefore "Every creature is not reaſonable."

When the antecedent or conſequent are negative propoſitions they are removed by an affirmative; as, "If there be no God, then the world does not diſcover creating wiſdom; but the word does not diſcover creating wiſdom; therefore there is a God." In this inſtance the conſequent is removed or contradicted in the minor, that the antecedent may be contradicted in the concluſion. So in this argument of St. Paul, 1 Cor. xv. "If the dead riſe not, Chriſt died in vain; but Chriſt did not die in vain; therefore the dead ſhall riſe.".

A diſjunctive ſyllogiſm is when the major propoſition is diſjunctive; as, "The earth moves in a circle or an ellipſis; but it does not move in a circle; therefore it moves in an ellipſis."

A diſjunctive ſyllogiſm may have many members or parts; thus, "It is either ſpring, ſummer, autumn, or winter; but it is not ſpring, autumn, or winter; therefore it is ſummer."

The true method of arguing here is from the aſſertion of one, to the denial of the reſt, or from the denial of one or more, to the aſſertion of what remains; but the major ſhould be ſo framed, that the ſeveral parts of it cannot be true together, though one of them is evidently true.

A relative ſyllogiſm requires the major propoſition to be relative; as, "Where Chriſt is, there ſhall his ſervants be; but Chriſt is in heaven; therefore his ſervants ſhall be there alſo." Or, "As is the captain, ſo are his ſoldiers; but the captain is a coward; therefore his ſoldiers are ſo too."

Arguments that relate to the doctrine of propoſition, muſt be referred to this head; as, "As two are to four, ſo are three to ſix; but two make the half of four; therefore three make the half of ſix."

Beſides theſe, there is another ſort of ſyllogiſm which is very natural and common, and yet authors take very little notice of it, call it by an improper name, and deſcribe it very defectively, and that is,

A connexive ſyllogiſm. This ſome have called copulative; but it does by no means require the major to be a copulative nor a compound propoſition; but it requires that two or more ideas be ſo connected either in the complex ſubject or predicate of the major, that if one of them be affirmed or denied in the minor, common ſenſe will naturally ſhew us what will be the conſequence. It would be very tedious and uſeleſs to frame particular rules about them: let therefore theſe two obſervations be ſufficient. 1. Moſt of them may be transformed into categorical ſyllogiſms by thoſe who have a mind to prove the truth of them that way; or they may be eaſily converted into each other by changing the forms of ſpeech. 2. Theſe conjunctive ſyllogiſms are ſeldom deficient or faulty in the form of them; for ſuch a deficiency would be diſcovered at firſt glance generally by common reaſon, without any artificial rules of logic: the chief care therefore is to ſee that the major propoſition be true, upon which the whole force of the argument uſually depends.

Compound SYLLOGISMS. We properly call thoſe compound ſyllogiſms which are made of two or more ſingle ſyllogiſms, and may be reſolved into them. The chief kinds are theſe, Epichireme, Dilemma, Proſyllogiſmus, and Sorites. See each under their proper heads. *Watts's Logic.*

SYMBOL, *Symbolum*, a ſign or repreſentation of any moral thing by the images or properties of natural things.

The word is formed from the Greek *συμβολον*, a mark, ſign, or badge, and that from the verb *συμβαλλειν*, *conferre*, to compare.

SYMMETRY, *συμμετρια*, relation of parity both in reſpect of height, length, and breadth of parts neceſſary to compaſs a beautiful whole.

The word is formed from the Greek, *συν*, with, and *μετρον*, meaſure.

SYMPATHETIC, ſomething that has a ſympathy, or that acts, or is acted on, by ſympathy.

Sympathetic is alſo particularly applied to all diſeaſes which have two cauſes, the one remote, and the other near.

SYMPATHETIC INK. See the article *Sympathetic* INK.

SYMPATHETIC POWDER. The compoſition of the famous ſympathetic powder, uſed at Goſſelaer by the miners in all their wounds, is this. Take of green vitriol, eight ounces: of gum tragacanth, reduced to an impalpable powder, one ounce; mix theſe together, and let a ſmall quantity of the powder be ſprinkled on the wound, and it immediately ſtops the bleeding. The vitriol is to be calcined to whiteneſs in the ſun, before it is mixed with the gum.

SAMPATHY, *συμπαθεια*, an agreement of affections and inclinations, or a conformity of natural qualities, humours, temperaments, &c. which make two perſons delighted and pleaſed with each other.

In medicine, ſympathy denotes an indiſpoſition befalling one part of the body, through the defect or diſorder of another; whether it be from the affluence of ſome humour, or vapour ſent from elſewhere; or from the want of the influence of ſome matter neceſſary to its action.

SYMPHONY, in muſic, properly denotes a conſonance or concert of ſeveral ſounds agreeable to the ear, whether vocal or inſtrumental, called alſo harmony.

The word is formed from the Greek *συν*, with, and *φωνη*, ſound.

SYMPHYSIS, in anatomy, one of the kinds of junctures, or articulation, of the bones. See ARTICULATION.

SYMPLEXIUM, in natural hiſtory, the name of a genus of foſſils, of the claſs of the ſelentiæ, but not of the

the determinate and regular figure of moſt of the genera of thoſe bodies; but compoſed of various irregular connections of differently ſhaped, and uſually imperfect, bodies.

The word is derived from the Greek *συμπλεκω*, to connect or compound a mixed maſs of different things.

SYMPOSIARCH, in antiquity, the director or manager of an entertainment.

SYMPTOM, *συμπτωμα*, in medicine, any appearance in a diſeaſe, which ſerves to indicate or point out its cauſe, approach, duration, event, &c.

SYMPTOM, in a large acceptation, ſignifies whatever preternaturally befalls a perſon, whether it be a diſeaſe, a morbific cauſe, or ſupervening preternatural accident. In a ſtrict ſenſe it means no more than the third or laſt ſpecies; that is, the conſequences of diſeaſes, and of their cauſes, excluſive of the diſeaſes and cauſes themſelves, and ſo is no other than a preternatural affection, which follows the diſeaſe, as the ſhadow follows the body.

SYMPTOMATICAL, in medicine, is a term often uſed to denote the difference between the primary and ſecondary cauſes in diſeaſes.—As a fever from pain is ſaid to be ſymptomatical, becauſe it riſes from pain only, and therefore the ordinary means in fevers are not in ſuch caſes to be had recourſe to, but to what will remove the pain; for, when that ceaſes, the fever will ceaſe without any direct means taken for it.

SYNÆRESIS, *συναιρεσις*, contraction in grammar, a figure whereby two ſyllables are united in one; as *vemens* for *vehemens*.

SYNAGOGUE, *Synagoga*, a particular aſſembly of Jews met to perform the offices of their religion. Alſo the place wherein they meet.

SYNALOEPHA, *συναλοιφη*, in grammar, a contraction of ſyllables, performed principally by ſuppreſſing ſome vowel or diphthong at the end of a word, on account of another vowel or diphthong at the beginning of the next. As *ill' ego*, for *ille ego*, &c.

SYNARTHROSIS, in anatomy, a ſpecies of articulation, wherein there is only an obſcure motion, as in the bones of the carpus and metacarpus, the tarſus and metatarſus, &c. or there is no motion at all, as in the ſutures of the ſkull, and articulation per harmoniam or bare application.

SYNCHONDROSIS, in anatomy, a ſpecies of ſymphyſis, being the union of two bones by means of a cartilage, as in the vertebræ.

SYNCOPATION, in muſic, denotes a ſtriking or beating of time, whereby the diſtinction of the ſeveral times or parts of the meaſure is interrupted.

However, it is more properly uſed for the connecting the laſt note of any meaſure, or bar, with the firſt of the following meaſure; ſo as only to make one note of both.

A ſyncope is ſometimes alſo made in the middle of a meaſure.

Syncopation is alſo uſed when a note of one part ends or terminates on the middle of a note of the other part. This is otherwiſe denominated binding.

It is likewiſe uſed for a driving note; that is, when ſome ſhorter note at the beginning of a meaſure, or half meaſure, is followed by two, three, or more longer notes before another ſhort note occurs, equal to that which occaſioned the driving, to make the number even, e. gr. when an odd crotchet comes before two or three minims, or an odd quaver before two, three, or more crotchets.

In ſyncopated or driving notes, the hand or foot is taken up, or put down, while the note is ſounding.

SYNCOPE, is a ſudden retardation or ſtoppage of the circulation of the blood.

It may proceed from a natural weakneſs, any violent paſſions, as ſurpriſe, fear, joy, &c. ſudden and large evacuations, as hæmorrhages, hypercatharſes profuſe ſweating, &c. breathing in an air too thin, or hot; hunger, loſs of appetite, &c.

It is known by a clammy ſweat on the face, leſs of colour in the lips, a tremor, dulneſs, and fixedneſs of the eyes; only their white ſometimes appearing; a ſmall languid pulſe; but in the very fit none at all is perceivable; and ſenſe and motion appear to be loſt.

When this caſe proceeds from the large evacuations, paſſions of the mind, natural weakneſs, breathing in an air too hot, or too much rarified, it is often fatal. Happening without any evident cauſe, it is reputed dangerous; frequent relapſes are alſo ſuppoſed dangerous, unleſs they be hyſterical.

In the fit apply volatile ſalts, &c. to the noſe, dip the hands in cold water, or ſprinkle it on the face; burn brown paper under the noſe, &c.

If it proceeds from a furious paſſion, and the patient be plethoric, bleed directly, and apply a bliſter, for fear the caſe ſhould grow convulſive or epileptic; and give a ſtrong, narcotic and repeat it pro re nata. But in depreſſed paſſions omit narcotics, and give wine, &c. and endeavour to make the patient chearful.

An emetic epiſpaſtic and the cold bath are proper for both kinds. In ſhort, proceed here as in the different ſpecies of madneſs, into which theſe caſes often degenerate.

If the cauſe was a violent diarrhæa, firſt put a ſtop to that, and then give a ſtrong cardic or opiate.

If from an hæmorrhage, and this does not ceaſe during the fit, uſe phlebotomy by way of revulſion, or give and repeat an opiate occaſionally; allow the patient to drink claret and water, corroborating jellies or broths, and let all manner of exerciſe and heat be avoided.

If the diſorder proceed from ſweating, through a laxity of pores, uſe the cold bath out of the fit.

If from artificial ſweating, let the patient cool gradually, by changing his place in the bed; and what he drinks ſhould not be made too warm.

When from mephitical exhalations, immediately expoſe the patient to the cool air; and, if this ſucceeds not, bleed him, or throw him into cold water.

When it proceeds from heat, or the air too much rarified, remove the perſon into an air that is colder and denſer; but when it is ſymptomatical, regard muſt be had to the original diſeaſe.

To prevent its happening from phlebotomy, let the patient bleed in a horizontal poſture, or lying on the bed.

SYNCOPE, in grammar, denotes an eliſium or retrenchment of one or more letters or ſyllables from a word.

As when we ſay *virum* for *virorum*, and *manet altamente repoſtum* for *repoſitum*.

SYNDIC, in government and commerce, an officer in divers countries, intruſted with the affairs of a city or other community; who calls meetings, makes repreſentations and ſolicitations to the miniſtry, magiſtracy, &c. according to the exigency of the caſe.

The word is formed from the Latin *ſyndicus*, and that from the Greek, *συνδικος*, which ſignifies the ſame.

Syndic is alſo uſed for a perſon appointed to ſolicit ſome common affair, wherein he himſelf has a ſhare; as happens, particularly, among ſeveral creditors of the ſame debtor, who fails or dies inſolvent.

SYNDROME, a word introduced into medicine by the empirics, who mean by it a concourſe of ſymptoms: thus under a plethora an empiric judges veneſection neceſſary from a ſyndrome of ſymptoms, ſuch as diſtenſion of the veſſels, a redneſs and gravity of the whole body, an indiſpoſition to motion, tenſions of the limbs, and a ſenſe of an ulcerous laſſitude, beſides a life ſpent in idleneſs, high and full feeding, and a ſuppreſſion of wonted excretions. This is the plethoric ſyndrome of an empiric, and after the ſame manner he forms a ſyndrome or concourſe of ſymptoms in a peripneumony, quinſey, epilepſy, and other diſeaſes. Galen ridicules theſe ſyndromes, becauſe, he ſays, they happen very rarely, and alſo very ſlowly; ſo that ſhould a phyſician wait for a ſyndrome of all the ſymptoms he expects, he might adminiſter his remedies to late.

SYNECDOCHE, in rhetoric, a kind of figure, or rather trope frequent among orators and poets.

The word is Greek, formed of *συνεκδεχομαι*, to take together.

There are three kinds of ſynecdoches; by the firſt, a part is taken for the whole; as the point for the ſword, the roof for the houſe, the ſails for the ſhip, &c.

By the ſecond, the whole is uſed for a part.—By the third, the matter of which the thing is made, is uſed for the

the thing itſelf; as ſteel for ſword, ſilver for mony, &c. —To which may be added another kind, where the ſpecies is uſed for the genus, or the genus for the ſpecies.

SYNECDOCHE, in Greek and Latin grammar, is when the ablative of a part or an adjunct of a ſentence is changed into the accuſative, the Greek propoſition κατα, or the Latin *ſecundum*, or *quod ad*, being underſtood. Examples of the ablative of the part being changed into the accuſative, are the following from Virgil. *Explera mentem nequit*, for *quod ad mentem*; and *Deiphobum videt lacerum crudeliter ora*, for *quod ad ora*; and an example of the ablative of the adjunct being changed into the accuſative from the ſame author, is as follows. *Flores inſcripti nomina regum*, for *quod ad nomina regum*.

SYNGENESIA, συνγενεσια, in botany, one of Linnæus's claſſes of plants, the nineteenth in order; ſo called becauſe the ſtamina in theſe plants grow together, or are formed into a ſingle regular congaries.

The general characters of this claſs are theſe: the cup is the crown of the ſeeds, and ſtands on the ſummit of the germen; and the compound flowers are very various, in regard to the nature of the floſcules. 1. Some are compoſed of tubuloſe hermaphrodite flowers in the diſk, and of the ſame ſort of tubulous hermaphrodite flowers in the radius. 2. Others are compoſed of tubuloſe hermaphrodite flowers in the diſk, and of tubulous female flowers in the radius. 3. Some are compoſed of tubulous hermaphrodite flowers in the diſk, and of tubuloſe neutral flowers in the radius. 4. Some have tubuloſe hermaphrodite flowers in the diſk, and ligulated hermaphrodite flowers in the radius. 5. Some are compoſed of tubulous hermaphrodite flowers in the diſk, and of ligulated female flowers in the radius. 6. Some are compoſed of tubulous hermaphrodite flowers in the diſk, and ligulated neutral flowers in the radius. 7. Some are compoſed of tubulous hermaphrodite flowers in the diſk, and of naked and neutral flowers in the radius. 8. Some are compoſed of tubuloſe male flowers in the diſk, and of naked female flowers in the radius. And, 9. Some are compoſed of ligulated female flowers in the diſk, and ligulated hermaphrodite flowers in the radius.

The ſtamina are five very ſhort and ſlender filaments, inſerted into the tube of the flower. The antheræ are of the ſame number with the ſtamina; they are ſlender, erect, and grow together at their ſides, ſo as to form a tubular cylindric body of the length of the mouth of the flower; and divided into five ſegments at the edge. The germen of the piſtil is oblong, and placed under the receptacle of the flower. The ſtyle is capillary erect, and of the length of the ſtamina, and goes through the cylinder formed by the antheræ. The ſtigma is divided into two parts, which ſtand open, and bend backwards.

Theſe plants have properly no pericarpium, though in ſome few ſpecies there is a coriaceous cruſt placed about the ſeed. The ſeed is ſingle and oblong, often of a quadrangular figure, and ſome times narrower at the baſe than in any other part. However, in different genera of this claſs, they are of a very different appearance at the ends. Some are crowned with a downy matter, compoſed of a great number of ſingle ſhort filaments, placed circularly, or otherwiſe, on the head of the ſeed. In ſome the downy matter is radiated; in others it is ramoſe or branched; and in ſome it is ſupported on a pedicle, while in others it ſtands immediately on the ſeed. In ſome genera the ſeeds have no down at all, but have a ſmall corona, formed of what was originally the cup of the flower. This is permanent, and divided uſually into five ſegments. In ſome genera the ſeed is wholly naked, having neither any down nor this crown of a cup.

SYNNEUROSIS, in anatomy, a kind of articulation of the bones, performed by the intervention of ligaments, See ARTICULATION.

The ſynneuroſis is reckoned a branch of the ſymphyſis, and is, when the bones are connected together by a ligament, as in the os femoris to the os iſchium, and the patella to the tibia.

SYNOCHUS, in medicine, a continual fever without any remiſſion. See FEVER.

SYNOD, in aſtronomy, a conjunction, or concourſe of two or more ſtars, or planets in the ſame optical place of the heavens.

SYNOD, or *Council*, in Eccleſiaſtical hiſtory, imply a meeting, or aſſembly of biſhops, or governors of the church, to rectify abuſes in faith or diſcipline, to enact laws or canons for the government of the church, and to regulate all matters relating to the ſtate of religion.

Under the article COUNCIL we have mentioned ſome of the moſt famous that have been held in the Church, and referred the reader to Du Pin's Hiſtory for a more ample detail; but at the requeſt of ſeveral of our ſubſcribers we have added here the following account of theſe famous aſſembles, and hope it will prove agreeable to our readers.

Some of theſe eccleſiaſtical aſſembles, are provincial, others national, and others oecumenical or general. Provincial ſynods, or councils, are thoſe in which the biſhops of one province only meet: national; thoſe in which the biſhops of one nation are aſſembled; and oecumenical or general, thoſe in which the biſhops from all parts of the Chriſtian world are aſſembled.

It was part of the office of the metropolitan biſhops, in the antient church, to call provincial ſynods, and preſide in them. And this they did by circular letters, called ſynodicæ and tractoriæ, which no biſhop of the province might diſobey under pain of ſuſpenſion, or ſome ſuch canonical cenſure, at the diſcretion of the metropolitan and the council. The canons appointed, that two ſuch ſynods ſhould be held yearly in each province, beſides ſuch as might be called upon extraordinary occaſions. And one reaſon aſſigned for it is this; that if any clergyman chanced to be unjuſtly cenſured by the paſſion of his biſhop, he might have recourſe to a ſuperior court, and there have juſtice done him.

Every biſhop had, at firſt, the privilege of ordering the affairs of his own dioceſe, independently of all other biſhops. But when the world became divided into ſeveral kingdoms, it was found neceſſary, that all the churches of ſuch or ſuch a nation ſhould, for the ſake of unity, and to avoid confuſion, obſerve the ſame cuſtoms and uſages. Hence national ſynods or councils were inſtituted, whoſe decrees were obligatory on all the churches of particular nations or kingdoms. And the ſame may be obſerved with reſpect to general or oecumenical councils, in which biſhops aſſembled from all parts of the world to conſult about ſuch matters as related to the good of the univerſal church.

The firſt ſynod we read of, is that held by the apoſtles themſelves at Jeruſalem, to deliberate whether the ceremonies of the Moſaical law were to be obſerved. Theſe aſſemblies were more rare in the three firſt centuries, and not ſo famous as in the following ages, as well becauſe the perſecutions of the Pagan emperors hindered the biſhops from aſſembling freely and publickly, as becauſe, the traditions of the apoſtles being yet new, it was not neceſſary to aſſemble councils, to eſtabliſh the truth and condemn error. In after ages, councils were very frequent, both on account of the neceſſity of eſtabliſhing diſcipline in the Chriſtian churches, which multiplied daily in all parts of the world, as alſo to condemn, and put a ſtop to, the numberleſs hereſies, that were perpetually ſpringing up, and diſturbing the peace of the church. Some councils were held by the heretics themſelves, where their power and influence were ſtrong enough.

The Firſt General Synod or Council of Nice, A. D. 325.

This council was held at Nice, in Bithynia. It was the emperor Conſtantine that called it, and it was compoſed of 318 biſhops. The legates of pope Sylveſter aſſiſted at it. It is not certainly known who was preſident of this aſſembly; but 'tis probable it was Hoſius biſhop of Corduba.

This council drew up a creed, in which it declared, that the Son of God was conſubſtantial with his Father: and anathematized all ſuch as ſhould ſay, there was a time when the Son of God did not exiſt, that he was created out of nothing, that he is of a different ſubſtance from his Father, and that he is liable to change. It condemned

demned Arius, who held that doctrine, with the biſhops Secundus and Theonas. It made a decree, that Eaſter ſhould be celebrated in all churches, on the Sunday after the fourteenth day of the moon of March; and drew up twenty canons about diſcipline. The emperor publiſhed the deciſions of this council to all the world, and the biſhops directed a letter particularly to the Chriſtians in Egypt, to inform them of what they had ordained, with relation to the Arians, and the feaſt of Eaſter.

The deciſions of the council of Nice were received by all the Churches, and no biſhops oppoſed them at firſt, excepting Secundus and Theonas, who were ſent into exile. But ſome time after, the partiſans of Arius endeavoured to overthrow the doctrine of the Council, by calling aſſemblies, in which they depoſed its chief defenders, and publiſhed other different confeſſions of faith. In 330 they held one at Antioch, in which Euſtathius biſhop of Antioch, who had been one of the chief prelates of the council of Nice, was depoſed. St. Athanaſius, who was ordained biſhop of Alexandria after the death of Alexander, one of the moſt zealous adverſaries of Arius, was cited to the council of Cæſarea in 333, and depoſed in that of Tyre in 335. Marcellus of Ancyra, who wrote againſt the Arians, was condemned in 336, in the council of Conſtantinople. Paul, biſhop of that city, was depoſed in another ſynod in 338. In the councils held at Antioch in 341, 342, and 344, the Euſebians drew up new articles of faith, different from thoſe of the Council of Nice. On the other ſide, St. Athanaſius was declared innocent in a council held at Alexandria in 340, and by a council, which Pope Julius held at Rome in 341. The biſhops of the Weſt ſubſcribed to the Nicene confeſſion in a council, aſſembled at Milan in 346.

The Firſt General Synod, or Council of Conſtantinople, A. D. 381.

This council was held in the beginning of the reign of Theodoſius. It was made up of biſhops from all parts of the Eaſtern Empire, except Egypt. Meletius, biſhop of Antioch, preſided in it, and eſtabliſhed St. Gregory Nazianzen in the ſee of Conſtantinople. It was in this ſynod, probably, that the canon was made againſt Maximus, who deſigned to take poſſeſſion of the ſee of Conſtantinople; and that, which granted the ſecond rank to the biſhop of Conſtantinople. Meletius died before the end of this ſynod.

Flavianus, who ſucceeded him in the beginning of the year 382, came to Conſtantinople with the biſhops of the Eaſt, whither alſo came the biſhops of Egypt. St. Gregory Nazianzen was obliged to renounce the ſee of Conſtantinople; and Nectarius was put in his place.

This council alſo drew up a creed, not very different from that of Nice, only adding to it more preciſe terms, to expreſs the divinity of the Holy Ghoſt, who is there called "the quickening Lord, who proceeds from the Father, who ought to be worſhipped with the Father and the Son, and who ſpake by the prophets." They likewiſe profeſs to believe "one only holy, catholick, and apoſtolical church; one only baptiſm for the remiſſion of ſins; the reſurrection of the body, and the life of a future ſtate." We have likewiſe ſix canons of this council.

The General Synod or Council of Epheſus, A. D. 431.

The emperor Theodoſius ſummoned this council. The time appointed for its meeting drawing near St. Cyril arrived at Epheſus, with fifty biſhops from Egypt: Juvenal alſo came with the biſhops of Paleſtine. But John of Antioch excuſed himſelf upon account of the diſtance, and wrote to St. Cyril, that he would come in five or ſix days time. The emperor ſent the count Candidianus, to maintain the ſafety and tranquillity of the council. Fifteen days after the calling of the council, St. Cyril, Juvenal, and the biſhops of Ægypt and Aſia, aſſembled in the great church of St. Mary, the 22d of June, altho' the legates of the holy ſee were not arrived.

The preſident of this council was St. Cyril: but ſome pretend it was in the name of the pope. It is certain Celeſtin commiſſioned him to execute the judgment paſſed againſt Neſtorius: but we have no ground to ſuppoſe, that he gave him charge to preſide in his name at the council of Epheſus; on the contrary, he ſent legates thither to repreſent himſelf: St. Cyril however takes the title of Celeſtin's repreſentative, in the ſubſcriptions.

The number of biſhops at this council was almoſt 200, according to the teſtimony of the council itſelf; the ſubſcriptions give us a liſt of 160; altho' the eaſtern biſhops do not reckon above fifty from Egypt, thirty from Aſia, and ſome others.

The day appointed for holding the council, as alſo that which John of Antioch, and the eaſtern biſhops, had prefixed for their meeting, being paſſed, the biſhops aſſembled. The count Candidianus propoſed, that they ſhould wait for the eaſtern biſhops, who were ſhortly to arrive; but Memnon biſhop of Epheſus remonſtrating, that they had waited for them ſixteen days, St. Cyril, and the other biſhops, proceeded, in the abſence of Candidianus, who withdrew. Neſtorius was cited thrice; but he anſwered, he would not appear till the eaſtern biſhops were come. The biſhops, after having recited the Nicene Creed, and heard the extracts of his writings, and the teſtimonies, by which he was convicted of having taught, that Mary was not the mother of God, and that he who was man, and had ſuffered in the perſon of Jeſus Chriſt, was a different perſon from God, declared him degraded from the epiſcopal dignity, and ſeparated from the ſacerdotalcommunion. The next day, this ſentence was ſignified to Neſtorius, and the council wrote to the emperor, and the clergy of Conſtantinople, what had paſſed.

The General Synod, or Council of Chalcedon, A. D. 451.

This council was held in the great church of St. Euphemia, in the preſence of the commiſſioners, officers of the Emperor Martianus, and counſellors of ſtate, who regulated every motion of it, and were ſeated in the middle of the aſſembly. At their left were Paſchaſinus and Lucentius, biſhops, and the prieſt Boniface, the Pope's Legates; then Anatolus of Conſtantinople, and after him Maximus of Antioch, and the biſhops of the Eaſt. On the right was Dioſcorus of Alexandria, Juvenal of Jeruſalem, and the biſhops of Egypt, Illyria, and Paleſtine. The holy Goſpels were placed in the middle. The number of the biſhops was about 600. However, there are but 350 in the ſubſcriptions.

Dioſcorus, and Euſebius of Doryleum, appeared there as parties. Euſebius accuſed Dioſcorus. Theodoret preſented himſelf in order to be admitted; but the biſhops of Egypt and Illyria oppoſed it. The commiſſioners ordered, that he ſhould enter as an accuſer. The acts of the council of Dioſcorus were read; upon which it was declared, That Flavianus, and Euſebius of Doryleum, had been unjuſtly condemned in that council, and that the biſhops, who had condemned them, deſerved to be depoſed. In the ſecond ſeſſion, they treated of matters of faith; the reſult whereof was, the approbation of the letter of St. Leo to Flavianus, wherein the error of Eutychius was condemned. Dioſcorus, being cited, in the third ſeſſion, and refuſing to appear, was depoſed. In the fourth, they received Juvenal of Jeruſalem, Thalaſſius of Cæſarea, and the other biſhops, who repented of having ſigned the judgment given againſt Flavianus, and who condemned Dioſcorus and Eutychius. There was a particular meeting held upon the difference between Euſtathius of Berytes, and Photius of Tyre, for the right of the metropolis. Photius gained the cauſe, and remained ſole Metropolitan, notwithſtanding the civil diviſion of the province, which the emperor had made. It was likewiſe decreed, that for the future the letters, which the cities ſhould obtain of the Emperor, to be erected into Metropolies, ſhould not prejudice the ancient Eccleſiaſtical Metropolies.

In the fifth ſeſſion, they drew up, and approved, a confeſſion of faith, in which it is declared, That we muſt believe in one only Jeſus Chriſt our Lord, the Son of God, perfect in his divinity, and in his humanity, conſubſtantial with God according to his divinity, and with men according to his humanity; who has two united natures, without change, diviſion, or ſeparation; ſo that the properties of the two natures ſubſiſt and agree in one and the ſame perſon; which is not divided into two, but is one only Jeſus Chriſt, the Son of God.

The emperor aſſiſted in perſon at the ſixth meeting, held on the twenty-fifth of November; at which time the confeſſion of faith was read over again, and approved, and ſigned by all the biſhops.

The Second General Synod, or Council of Conſtantinople, A. D. 553.

The diſpute about the three chapters is one of thoſe, which was debated with the greateſt heat of any in the VIth Century. The origin and progreſs of it was briefly this.

Pelagius, ſurrogate of the church of Rome, reſiding in the Eaſt, in hatred to Theodorus biſhop of Cæſarea, got Origen to be condemned by an edict of the emperor Juſtinian, in the year 541. Mennas, patriarch of Conſtantinople, and the other biſhops, approved and received that judgment. Theodorus was of the ſect of the Acephali, or Eutychians, who did not receive the determination of the council of Chalcedon. The empreſs Theodora favoured that ſect; but Juſtinian, who owned the authority of the council of Chalcedon, reſolved to condemn it. Theodora, to ward off that blow, and to be revenged for the condemnation of Origen, repreſented to the emperor, that it was needleſs to publiſh any edict againſt the Acephali, who would all re-unite, and approve the council of Chalcedon, if Theodorus of Mopſueſta and his writings were anathematized, the writings of Theodoret againſt St. Cyril condemned, as alſo the letter of Ibas biſhop of Edeſſa, which had been read in the council of Chalcedon. The emperor, imagining he ſhould do a great benefit to the church, in procuring the re-union of ſeveral perſons, by the condemnation of three dead authors, whoſe reputation was doubtful, publiſhed an edict, condemning the three writings above-mentioned; which afterwards became ſo famous under the name of the three chapters. This edict was publiſhed towards the end of the year 545. And to add a greater authority to this condemnation, the emperor cauſed a council to be aſſembled at Conſtantinople in 546, which condemned the perſon and writings of Theodorus biſhop of Mopſueſta, the writings of Theodoret againſt the twelve articles of St. Cyril, and Ibas's letter.

The Third General Synod, or Council of Conſtantinople, A. D. 680.

This council of Conſtantinople began in the thirteenth year of the emperor Conſtantine Pogonatus, and was concluded in eighteen ſeſſions. The emperor held the firſt place in it, and aſſiſted in perſon at the firſt eleven meetings, and at the laſt. He was attended with conſuls and officers. The Patriarchs of Conſtantinople and Antioch aſſiſted in perſon; thoſe of Rome, Alexandria, and Jeruſalem, by deputies; and all the weſtern biſhops, by three deputies from the council of Rome, with ſeveral eaſtern biſhops, whoſe number increaſed as they came to Conſtantinople: for at firſt there were only between thirty and forty preſent; but at laſt they amounted to above 160.

This was the order obſerved amongſt the patriarchs of this council. The pope's legates held the firſt rank; George, patriarch of Conſtantinople, the ſecond; a deputy from the church of Alexandria the third; Macarius, patriarch of Antioch, the fourth; the patriarch of Jeruſalem the fifth; and the deputies from the council of Rome the ſixth: after theſe were the deputies of the church of Ravenna, and then the biſhops and abbots.

At the firſt meeting, the pope's legates accuſed the patriarchs of Conſtantinople and Antioch of having invented and maintained novelties, teaching, that there was but one will in Jeſus Chriſt. Macarius, patriarch of Antioch, undertook their defence. The acts of the councils were ordered to be read; and in this ſeſſion they read thoſe of the council of Epheſus; in the following, thoſe of the council of Chalcedon; and in the third, held the thirteenth of November, thoſe of the fifth general council. At the fourth meeting, they read the letters of pope Agathon, and thoſe of the council of Rome. Macarius produced, at the fifth and ſixth meetings, ſeveral paſſages out of the fathers, which he thought favoured his opinion. At the ſeventh meeting, held the thirteenth of February 681, pope Agathon's deputies preſented a collection of other paſſages out of the fathers, to prove the doctrine of two wills. At the eighth meeting held the ſeventh of March, the patriarch of Conſtantinople, having examined pope Agathon's letter, and the paſſages out of the fathers, declared he was of the ſame ſentiments with the pope, and the other weſtern biſhops. All the biſhops of his patriarchate made the like declarations, excepting Theodorus biſhop of Melitinum, who deſired that neither party might be condemned.

Macarius, biſhop of Antioch, perſiſted in his opinion, and ſtrenuouſly maintained, that there was but one operation, and one will in Jeſus Chriſt. He was heard as a party; and at the ninth meeting, they examined the paſſages, upon which he founded his opinion. At the following meetings, they continued to examine the writings on both ſides, and the authorities, which were alledged.

In fine, at the ſeventeenth meeting, held the ſixteenth of September 681, at which the emperor aſſiſted, they publiſhed a deciſion, by which they approved pope Agathon's letter, and the deciſion of the council of Rome; importing, that there are two natural wills, and two operations, in Jeſus Chriſt, in one only perſon, without diviſion, mixture, or change; although thoſe wills are not oppoſite, but the human will follows the divine, and is entirely ſubject to it. This deciſion was approved by all the biſhops of the council, who pronounced an anathema againſt the old and new heretics, and in particular againſt Honorius, who is always reckoned amongſt the Monothelite patriarchs, and comprized in the ſame condemnation. Macarius biſhop of Antioch, and two other biſhops, called Stephen and Polychronius, who perſiſted in their ſentiments, were depoſed.

The eaſtern and weſtern churches, that were united in the ſame faith and communion, approved the deciſion of the council, and the anathema, which was pronounced againſt the biſhops, who had maintained the contrary error. The emperor publiſhed an edict againſt the Monothelites, which entirely appeaſed the troubles of the eaſtern churches.

The Second General Synod, or Council of Nice, A. D. 787.

The emperor Leo Iſaurus, reſolving to aboliſh the uſe and worſhip of images, which were received in the Eaſt, publiſhed an edict, in 730, by which he ordered them to be taken out of the churches, and thrown into the fire. His ſon Conſtantine Copronymus followed the example of his father; and, the better to eſtabliſh the diſcipline he had a mind to introduce, he cauſed a council to be aſſembled at Conſtantinople, in 754, conſiſting of 338 biſhops, who made a decree againſt the worſhip of images. This council was not received in the church of Rome; but the emperor cauſed the decree to be executed in part of the eaſtern churches.

When Irene became miſtreſs of the empire, ſhe reſolved to aſſemble a new council, to which ſhe invited pope Adrian, who ſent thither two prieſts as his deputies. The council met at Conſtantinople in 786; but, being diſturbed by the officers of the army and the ſoldiers, who were ſtirred up by the biſhops that oppoſed the worſhip of images, it was transferred to Nice in 787. The pope's legates held the firſt place in it: Taraſius, patriarch of Conſtantinople, the ſecond; and the deputies of the biſhops of the Eaſt the third; after them, Agapetus biſhop of Cæſarea in Cappadocia, John biſhop of Epheſus, Conſtantine metropolitan of Cyprus, with 250 archbiſhops and biſhops, and above a hundred prieſts and monks. Two commiſſioners from the emperor and empreſs aſſiſted at it.

The firſt meeting was held the fourteenth of September, in St. Sophia's church. They received the biſhops, who, changing their opinion, made profeſſion of honouring images for the future. At the ſecond meeting, held the twenty-eighth of the ſame month, pope Adrian's letters to the emperor Conſtantine, and Taraſius patriarch of Conſtantinople, were read, in which that pope approved the worſhip of images. Taraſius declared, that he approved the worſhip of the images of the virgin, of angels and ſaints, although he adored none but God alone with the ſovereign worſhip of Latreia, and put his truſt in him only. All the biſhops made

made the ſame declarations. At the third meeting, held the twenty-eighth of September, they likewiſe admitted ſome biſhops, who abjured the decree of the preceding council. They read the ſynodical letter, which Taraſius had ſent to the patriarchs, in which he had added to his confeſſion of faith, about the Trinity and Incarnation, the interceſſion of ſaints, of the virgin, of angels, and the worſhip of their images. They likewiſe read the letter of Theodoſius of Jeruſalem, which had been approved by the eaſtern biſhops, wherein the worſhip of images was likewiſe maintained. At the fourth meeting, Taraſus cauſed to be read the teſtimonies of the ſcripture, and of the ſaints, which, he pretended, authoriſed the worſhip of images. At the fifth meeting, they continued to produce pieces, to ſhew, that the Iconoclaſts had imitated the antient heretics in breaking down images. The ſixth meeting, held the fifth or ſixth of October, was employed in reading and refuting the acts of the council of Conſtantinople, which had condemned the worſhip and uſe of images.

The Fifth General Synod or Council of Conſtantinople, A. D. 869.

In the Eaſt, after the death of Methodius, patriarch of Conſtantinople, Ignatius, ſon to the emperor Michael Curopalata, who had till then led a monaſtical life in the iſles of Hieres and Terebinthus, which were by him planted with monaſteries, was raiſed to the ſee of Conſtantinople, in the year 845. There was, at that time, one Bardas, brother to the empreſs Theodota, niece to Michael, who had a great ſhare in the government; he was deſperately in love with his daughter-in-law, and had familiarity with her. Ignatius reproved his crime with ſuch freedom as became a holy biſhop, and, perceiving that Bardas did not repent, refuſed to admit him to the ſacraments. This refuſal incenſed Bardas; but he waited till another time to ſhew his reſentment. He perſuaded Michael to take the government into his own hands, and to confine his mother and ſiſters in a nunnery. The emperor ordered the patriarch to do it; but he refuſed, which furniſhed Bardas with an opportunity to charge him with favouring the rebellion of a man, who called himſelf the ſon of Theodota by another huſband. Michael cauſed his mother and ſiſters to be ſhut up, and baniſhed Ignatius to the iſland of Terebinthus, requiring him to reſign; and though the patriarch refuſed ſo to do, yet the emperor put Photius into his place.

Ignatius, within two months after Photius's advancement to the ſee of Conſtantinople, was removed from the iſland of Terebinthus to that of Mitylene. Photius, having convened a ſynod, declared his depoſition, and anathematized his perſon. Being deſirous to have this judgment authorized by the biſhop of Rome, he deputed two biſhops to pope Nicolas I, who ſucceeded Benedict III. in the year 858, deſiring him to ſend his legates to Conſtantinople, to reſtore eccleſiaſtical diſcipline, and wholly ſuppreſs the remains of the ſect of the Iconoclaſts, or oppoſers of images. The pope ſent two biſhops to Conſtantinople, in quality of his legates, named Zecharias and Radoaldus, with full power to regulate the affair of the Iconoclaſts, and to take informations as to what concerned Ignatius, in order to make their report to the holy ſee. He at the ſame time wrote to the emperor againſt the depoſition of Ignatius, and the ordination of Photius.

The two legates being come to Conſtantinople, in the year 861, were preſent at a council of 318 biſhops, to which Ignatius was ſummoned. He appeared the firſt ſeſſion, was preſſed to reſign, and upon his refuſal, ſummoned to appear a ſecond time before the ſynod. He was brought thither by force, and the council pronounced ſentence of depoſition againſt him.

This aſſembly took alſo into conſideration the worſhip of images, which was there confirmed, and ſeventeen canons were paſſed relating to biſhops, monks, and other clergymen. After this, Ignatius was cloſely confined, and by force compelled to ſign an inſtrument, importing, that he owned himſelf unworthy of the epiſcopal dignity; that he had been preferred to it by indirect means, and had not been a lawful profeſſor of it. This confeſſion under his hand having been extorted from him, they would have obliged him to read it in publick; but he made his eſcape in the habit of a peaſant, lay concealed in the iſlands, and ſent a petition of appeal to the pope. The emperor, on the other hand, ſent to Rome the acts of the council againſt him, and wrote to the pope, perſuading him to conſent to the depoſing of Ignatius, and the ordination of Photius: but Nicolas I. anſwered, that he diſapproved of both, and, calling a council at Rome, declared Photius deprived of the prieſthood; ordered the reſtoring of Ignatius; and declared all the ordinations made by Photius void.

The patriarch Ignatius had been allowed to live in the iſland of Terebinthus; but Photius, making uſe of forged letters to accuſe him of holding intelligence in the Weſt, and writing againſt the emperor, cauſed him to be impriſoned. The fraud being diſcovered, Ignatius was ſet at liberty. Bardas was ſome time after put to death by the emperor's order: but this did not obſtruct Photius's perſuading the emperor Michael to aſſemble a council at Conſtantinople, in which he cauſed pope Nicolas to be accuſed, depoſed, and excommunicated. This council was held in 866; but, the next year, Baſilius, who had been declared emperor after the death of Bardas, having killed Michael, reſtored Ignatius, and baniſhed Photius into a monaſtery. Ignatius immediately excommunicated Photius, and deſired of the emperor, that a general council might be ſummoned.

This council met at Conſtantinople in the year 869. Donatus and Stephen, legates to pope Adrian II. who ſucceeded pope Nicolas in the year 867, preſided in it. Only the biſhops, who had adhered to the patriarch Ignatius, were admitted to the firſt ſeſſion. The others, having afterwards renounced all communion with Photius, and acknowledged Ignatius, were admitted to the following ſeſſions; ſo that the council conſiſted of 100 biſhops. The judgment, given by the pope in the council at Rome, was approved. Photius was brought in and degraded, as were thoſe he had ordained; his perſon was anathematized, and the acts of his council againſt pope Nicolas condemned. The worſhip of images was confirmed, and ſeveral regulations made for eſtabliſhing peace and diſcipline in the eaſtern church, and for ordering the elections of patriarchs and biſhops. Theſe regulations are contained in twenty-ſeven canons. In concluſion, a very ample confeſſion of faith was read, and ſigned by all the biſhops, together with the acts of the council.

The Firſt General Synod or Lateran Council, A. D. 1123.

This council, which approved the treaty made between the emperor Henry V. and pope Calixtus II. concerning the ceremony of beſtowing the inveſtiture of eccleſiaſtical poſſeſſions, which had occaſioned warm diſputes between the imperial court and that of Rome, was aſſembled by pope Calixtus in the palace of the Lateran at Rome, and conſiſted of above 300 prelates: which great number of biſhops occaſioned the name of General to be given to it, as it was to other numerous councils, held afterwards in the Weſt, though the eaſtern biſhops did not aſſiſt at them.

The Second General Lateran Synod or Council, A. D. 1139.

This council was aſſembled by pope Innocent II. in the palace of the Lateran, and was compoſed of near 1000 biſhops, and thirty canons were made in it.

The Third General Lateran Synod or Council, A. D. 1179.

This council was convened by pope Alexander III. to reform a great number of abuſes that had crept into the church, to regulate diſcipline, and to condemn the Albigenſes, and other reputed heretics. This council was compoſed of about 300 biſhops, and made twenty-ſeven canons.

The Fourth General Lateran Synod or Council, A. D. 1213.

This council was called by Innocent III. for the recovering of the Holy Land, and the reformation of the univerſal church. The prelates came to Rome, and compoſed a council of 412 biſhops, almoſt 800 abbots and priors, and a great number of deputies of abſent biſhops. The Latin patriarchs of Conſtantinople and Jeruſalem

Jeruſalem aſſiſted at it in perſon; thoſe of Antioch and Alexandria ſent deputies thither. The embaſſadors of the emperor of Conſtantinople, of the king of Sicily, and of the kings of France, England, and Jeruſalem, of Cyprus, Arragon, and other princes, were preſent. The pope opened the ſynod with a ſpeech concerning the recovery of the Holy Land, and the reformation of the church. Then he cauſed to be read in full council ſome chapters, or regulations, about the diſcipline of the church, which were all drawn up in form. Theſe chapters amount to the number of ſeventy.

Theſe canons perfected the body of the canon law, and regulated the practice of eccleſiaſtical procedures, which are followed to this day. And this council is in ſo muſt eſteem among the Canoniſts, that it is commonly cited, in the canon law, by the name of The General Council.

In this council, it is ſaid, the patriarch of the Maronites united his nation with the church of Rome; that the queſtion about the primacy of the archbiſhop of Toledo was debated; and that the pope inſtituted the order of the Cruſaders; and approved the orders of St. Dominic and St. Francis.

This council, which was very numerous at the beginning, was diſperſed in leſs than one month. The prelates, being tired with ſtaying at Rome, did one after another aſk leave to be gone, and the pope, if we may believe Matthew Paris, made them buy their permiſſion to depart. The war of the Piſantines and Genoeſe, and the troubles of Italy, ſoon obliged the pope to put an end to the council.

The Firſt General Synod, or Council of Lyons,
A. D. 1245.

This council was aſſembled by pope Innocent IV. with a deſign to depoſe the emperor Frederic; and accordingly the pope pronounced a ſentence of excommunication and depoſition againſt him. Beſides this, there were three other affairs handled in this council; viz. firſt, the aſſiſting the empire of Conſtantinople againſt the Greeks; ſecondly, that of Germany againſt the Tartars; and thirdly, that of the Holy Land againſt the Saracens. The pope ordered a ſupply out of the revenues of benefices for the aſſiſtance of the empire of Conſtantinople. To ſtop the incurſions of the Tartars into Poland, Ruſſia, and Hungary, he adviſed the people to make ditches and build caſtles. As to the ſuccours for the Holy Land, he exhorts the cruſaders to repentance; grants them exemptions, privileges, and indulgences; deſtines the twentieth part of the revenues of benefices for their aſſiſtance; counſels the faithful to leave them, by their wills, ſums, to be employed for that pious work; and forbids Chriſtians to furniſh the Saracens with arms or proviſions.

The pope likewiſe publiſhed, in this council, divers regulations concerning the canon law; as about commiſſions, erections, the power of judges delegate, procedures touching appeals, accuſations, excommunications, debts contracted by churches, and ſeveral other points of law.

The Second General Synod, or Council of Lyons,
A. D. 1274.

The ſecond general council of Lyons was called by Gregory X. in 1274, for three reaſons given in the bull of indiction. I. For the re-union of the Greek church. II. For ſuccours to the Holy Land. III. For the reformation of eccleſiaſtical diſcipline and of the lives of the clergy. The pope preſided there in perſon. The Latin patriarchs of Conſtantinople and Antioch were there alſo, with about 500 biſhops, ſeventy abbots, and 1000 other inferior prelates. The ambaſſadors of the kings of France, Germany, and Sicily, and thoſe of Michael Paleologus, emperor of the Eaſt, were ſent thither by their maſters. James king of Arragon aſſiſted at their firſt meeting; but the pope refuſing to crown him, unleſs he would pay the tribute which his father had engaged himſelf to give to the holy ſee every year, he went away in wrath againſt the pope.

The firſt ſitting of the council was held in the great church of Lyons on the 7th of May 1274. After the uſual prayers, the pope made a ſpeech, and propoſed to the aſſembly the reaſons, for which the council was aſſembled. He delayed the ſecond ſeſſion to the 18th of the ſame month. In this ſeſſion he made another harangue, and put off the council to the 28th of the ſame month, after having ſent home part of the inferior prelates. Between theſe two ſeſſions, the pope prevailed with the biſhops and abbots to grant the tenth of their revenues for the ſpace of ſix years, for the ſuccour of the Holy Land.

The General Synod, or Council of Vienna, A. D. 1311.

This council, at Vienna in 1311, was called by Clement V. in order to judge what concerned the Templars. The firſt ſeſſion was held the 16th of October: near three hundred biſhops aſſiſted at it. The ſecond was held the 22d of May, 1312.

In this council the extinction of the order of the Templars was reſolved upon, and the bull for it was publiſhed. The memory of Boniface VIII was defended, notwithſtanding the inſtances of the king of France. A cruſade was likewiſe reſolved upon. They condemned the Beguards and Beguins, whoſe errors had been proſcribed, and, during this council, the pope made divers conſtitutions, which are in the five books of Clementines, publiſhed by John XXII. and inſerted in the body of the canon law; but ſome of thoſe conſtitutions had been made before this council, and others after; and of thoſe, which were made in the time of this council, none but ſuch as regard faith, the regulations touching the privileges of Mendicants, the ſtudy of the languages in the univerſities, and the condemnation of the Beguards and Beguins, take any notice that they were approved.

The General Synod, or Council of Conſtance,
A. D. 1414.

About the beginning of the XVth century, the church was divided, there being three popes inſtead of one, viz. John XXIII. Gregory XII. and Benedict XIII. To extinguiſh this ſchiſm, they had recourſe to a general council, which ſhould be acknowledged on all ſides. John XXIII. called one at Rome, in conſequence of the prorogation of that of Piſa by his predeceſſor: but, that city being in the poſſeſſion of Ladiſlaus, he agreed with the emperor Sigiſmund, that the council ſhould meet at Conſtance, and appointed it on the 7th of November 1414. Ladiſlaus, who was preparing to come and beſiege John XXIII. in Bologna, was ſeized with a fit of ſickneſs, which obliged him to return to Naples, where he died, leaving his kingdom to his ſiſter Joan the ſecond of that name, widow to William of Auſtria. John XXIII. being delivered from ſo formidable an enemy, departed for Conſtance, and arrived there the 20th of October. He opened the council the 16th of November: but nothing was done till next year.

In fine, after ſeveral ſummons, Benedict was declared contumacious, ſchiſmatical, and depoſed by the council, in the twenty-ſeventh ſeſſion, on the twenty-ſeventh of November.

After theſe three, who pretended to the popedom, had been depoſed, it was neceſſary to chuſe another pope, who ſhould be univerſally acknowledged. Before they proceeded to the election, the council drew up articles for the reformation of the church, in its members, and in its head. They ordained a general council to be held, five years after this was ended; and that for the future one ſhould be held every tenth year: That the pope might haſten the holding of that council, but not retard it: That whenever there ſhould happen to be two pretenders to the pontificate, a council ſhould be immediately held; and that the pretenders ſhould be ſuſpended from all power and juriſdiction, till ſuch time as the council was begun: That, in caſe an election ſhould be made through fear or force, it ſhould be null; but that the cardinals ſhould not proceed to a new election, till ſuch time as the general council had determined the invalidity of that, which had been made. Then the council publiſhed, in the fortieth ſeſſion, the articles of reformation, which the future pope ſhould endeavour, with the council. Theſe articles are eighteen in number. None of them were diſputed, but that of the annates; however, it paſſed that they ſhould be aboliſhed.

After this the council ordered, that they ſhould proceed to the election of a pope. And, that this election might

might be the more ſolemn, it was ordered, for this time only, that ſix prelates of every nation ſhould be joined with the cardinals, and that he who ſhould be choſen by two thirds of the cardinals, and two deputies of each nation, ſhould be acknowledged for ſovereign pontiff. This was immediately executed. The cardinals and deputies of the council went into the conclave, and unanimouſly elected Odon Colonna, cardinal-deacon of St. George, who took the name of Martin V. becauſe he was elected on St. Martin's Day, 1417. He was enthroned that very day, and crowned the one and twentieth of the ſame month. He preſided in the forty-ſecond ſeſſion, which was held on the 28th of December. In the forty-third ſeſſion, which was held the 21ſt of March, 1418, he publiſhed ſome conſtitutions for the reformation of the church. But he did not make all the regulations projected by the council. In fine, to ſatisfy the decree of the council, he appointed the future council at Pavia, and put an end to the council the 22d of April.

The General Council of Baſil, A. D. 1431.

This council was convened by pope Eugenius IV. in order to re-unite the Greek and Latin churches, but it could not ſucceed.

The General Council of Trent, A.D. 1545.

This was the laſt general council that has been held, the popes ſince that time not thinking fit to expoſe their authority to the encroachments that have been, and might again be made upon it by ſuch aſſemblies.

This council was convened by pope Paul III. and aſſembled at Trent, a town on the confines of Tirol, between Italy and Germany, on the 13th of December. The biſhops, at firſt, ordered the manner of proceeding in the council, and decreed, that they ſhould not vote by nations, according to the precedents of the councils of Conſtance and Baſil; that method appearing to them unfair, and being the occaſion of diſorder. It was therefore reſolved, that every one ſhould have the freedom to vote in his own perſon, and that the matters in queſtion ſhould be governed by the majority, according to the practice of the laſt Lateran council under Leo X. The proteſtants inſiſted upon a council perfectly independent of the pope. They pretended likewiſe, that the laity ought to have the liberty of voting: but to prevent ſuch an imputation upon the council, they ſtiled themſelves, The Holy Oecumenical Council, and not the council repreſenting the univerſal church, (which latter was the form of the councils of Conſtance and Baſil,) that the proteſtants might have no pretence of ſaying, that ſince the laity were members of the church repreſented, they ought alſo to be members of the church repreſenting. The third ſeſſion was held Feb. 4, 1546, where there were preſent five new cardinals, ſix archbiſhops, thirty biſhops, and a great many abbots: here the creed of Conſtantinople was read; and, that there might be time given for the biſhops upon their journey, the fourth ſeſſion was prorogued to the 4th of April; at which there were preſent nine archbiſhops and forty-one biſhops. Then, according to the cuſtom of antient councils, the number of the canonical books of the Old and New Teſtament, and the traditions conveyed down by the church, from the apoſtles to the preſent age, were ſettled. The council likewiſe declared, that the vulgar Latin tranſlation ought to be eſteemed authentic. In the fifth ſeſſion they decreed what was neceſſary to be believed concerning original ſin; the council declaring amongſt other things, "That though this ſin be remitted in baptiſm, yet concupiſcence, which is the effect of ſin, remains." The ſixth ſeſſion, upon the occaſion of ſome diſturbances in Germany, was adjourned to the 13th of January, 1547, in which the decree concerning juſtification paſſed, wherein 33 errors were condemned; ſome of which were the tenets of the Pelagians, who allow too much to the will, aſſiſted only by natural ſtrength: Others of theſe cenſured opinions were held by the Lutherans, who aſcribe all to the grace of God, which, ſay they, governs and over-bears the will by an irreſiſtible force. The ſeventh ſeſſion was held on the 3d of March, when they publiſhed a decree concerning the ſacraments in general, i. e. concerning the number, perſon inſtituting, the neceſſity, efficacy, matter, form, and miniſter of the ſacraments.

In the eighth ſeſſion, held on the 11th day of March, a tranſlation of the council to Bononia was reſolved on, upon the account of a report of the plague being in Trent; but this reſolution being oppoſed by the biſhops of Germany, who continued to ſit at Trent, after the Italians were gone off, the council was re-commenced, or rather continued at Trent the firſt of May, under pope Julius III. in 1551. In the thirteenth ſeſſion held that ſame year, October 11, a decree concerning the euchariſt was read; in which the council concluded againſt the Sacramentarians, "That Jeſus Chriſt was really preſent in the holy ſacrament of the altar;" and againſt the Lutherans, they confirmed the doctrines of tranſubſtantiation, the adoration of the hoſt, and the preſence of Jeſus Chriſt, at other times beſides that of actual receiving. They refuſed to define the point of communion under both kinds for the laity, and the ſacrifice of the maſs; that the proteſtant divines, who ſeemed very much concerned in the ſettling of theſe diſputes, and to whom they had granted a ſafe-conduct, might have time to arrive, and propoſe the reaſons of their opinions to the council. In the fourteenth ſeſſion, begun Nov. 25, 1551, the doctrine of the church concerning the ſacraments of penance and extreme unction were declared. As to penance, the council ſet forth the neceſſity and inſtitution of this ſacrament, how it differed from Baptiſm; and enlarged upon the three branches of it, viz. contrition, confeſſion, and ſatisfaction: they likewiſe ſet forth the inſtitution and effects of extreme unction. In the fifteenth ſeſſion, begun the 15th of January, 1552, they granted a new ſafe-conduct to the proteſtants, and adjourned till the firſt of May, to give others time to repreſent their reaſons to the council, concerning communion in both kinds, the ſacrifice of the maſs, and the ſacraments of orders and marriage. The divines, in the mean time, held congregations to ſtate the diſputes about marriage, and to form decrees upon their concluſions, in order to propoſe them in the ſixteenth ſeſſion; which being appointed, and ready to commence on the 28th of April, they underſtood, that Maurice, elector of Saxony, having joined his troops with thoſe of the marquis of Brandenburg and landgrave of Heſſe, in defence of Lutheraniſm, had made himſelf maſter of Augſbourg, and ſeemed to threaten the ſecurity of Trent.

This turn of affairs obliged the legates to ſuſpend the council by the permiſſion of Julius III; neither had they any opportunity of ſetting it on foot again during the pontificates of Marcellus II. and Paul IV. But Pius IV. convened it again by his bull dated the 29th of November, 1560, to be held on Eaſter-day the year following. In this bull, he did not make uſe of the term continuation; that word being very offenſive to the proteſtants, becauſe they knew themſelves condemned in ſeveral articles in the former ſeſſion of the ſynod. However, tho' the pope forbore the term, he expreſſed the thing, declaring, that the oecumenical council being ſuſpended by reaſon of the wars, he took off this ſuſpenſion, and convened it in the ſame town of Trent, with the conſent of the emperor, kings, and other Chriſtian princes. And becauſe, at the time aſſigned for the new opening of the council, there was but nine biſhops arrived at Trent; the firſt ſeſſion, i. e. the ſeventeenth of the council, was not held till the 18th of January, 1562; in which a decree only was drawn up and read, declaring, that the council intended to treat upon all thoſe heads, which they thought proper to compoſe the differences relating to religion, and which were neceſſary for the correction of abuſes, the reformation of manners, and for the reſtoring of peace and good order to the church. In the eighteenth ſeſſion, there was a decree made concerning the index or catalogue of prohibited books; but this index was not publiſhed during the ſitting of the council, that the proteſtants might not be diſobliged, by finding themſelves condemned in their writings: there was likewiſe a ſafe-conduct granted not only for the Lutherans of Germany, but for all other nations.

In the twentieth ſeſſion, the ambaſſadors of the king of France being arrived, embaraſſed the council's proceedings: for theſe ambaſſadors not only demanded (like the imperialiſts) that the propoſal of the Spaniards ſhould be rejected, who would have had a declaration paſs, that the council was only a continuation of the former; but the

French insisted on the contrary, that the council should be declared a new one; because otherwise not only the protestants of Germany, but likewise those of France, would never own it. To this the pope's legates having replied, that they had no commission to change any thing, and much less to make a new form of indiction, the ambassadors of the emperor and France acquiesced at last, for fear the council should break up. In the mean time, the ambassadors of the emperor and duke of Bavaria, those of Hungary and Bohemia, together with those sent from the French king, desired, that, for the gaining of the protestants, communion under both kinds might be allowed. This matter was discussed in several congregations; after which, in the twenty-first session, the council made a decree, that it was matter of faith to believe, that communicating in one kind, as to the laity, and clergy that do not consecrate, is sufficient for salvation; and so, without dwelling upon this point any longer, they examined the sacrifice of the mass; the decree concerning which, being read in the twenty-second session, sets forth, "That the unbloody sacrifice of the eucharist is a daily representation of that upon the cross; that it is propitiatory for the living, and for the faithful who are deceased; that it is offered to God alone, tho' sometimes in honour of the saints, and out of regard to their memory." Afterwards having, according to their customary proceedings, made two decrees for the reformation of manners and discipline, they fixed the twenty-third session for the 12th of November; but the emperor Ferdinand, and king Charles IX. of France, insisting upon a reformation of the court of Rome, they were obliged to defer it till July 1563.

Now the pope having satisfied these princes, by letting them understand, that he had already begun the reformation desired, and that his zeal in this matter would go on as far as could be reasonably expected, the twenty-third session commenced on the 15th of July, in which the council decreed the doctrine of the sacrament of orders, i. e. "That there were always seven orders in the church, some of which are greater than others: that those only are priests, who receive ordination from bishops: that orders are a sacrament, &c." In the twenty-fourth session held the 11th of November, the council declared, "That marriage is a true sacrament; that the state of marriage ought not to be preferred to virginity or celibacy, &c. The twenty-fifth and last session was held upon the 3d and 4th of December, in which there were three decrees published concerning purgatory, invocation of saints, and the use of indulgences. After this, the council remitted all disputes and contested senses, which might arise concerning the meaning of their decrees, to the pope's determination. And thus ended this famous council, which had been thrice convened in the space of eighteen years, having continued from 1545 to 1563, under the pontificates of five popes, viz. of Paul III. Julius III. Marcellus II. Paul IV. and Pius IV.

In England, every bishop was obliged (formerly) to hold a synod in his diocese once a year. This Lindwood seems to deliver as the rule of the English church: and the same is established in the designed reformation of the canons, drawn up in the reign of king Henry VIII.

To these annual synods all the clergy, who had any benefice within the diocese, were obliged to come, under the penalty of suspension. The regulars too, as well abbots as monks, were bound to this attendance; excepting those, who, in process of time, were exempted from episcopal jurisdiction. If the diocese was small, and had but one archdeaconry in it, the whole clergy met together at once. If it were larger, the bishop sometimes divided his synods according to the number of his archdeaconries, and held his diocesan council at several times, and in several places: but still the method of business was the same in all.

The form of holding these diocesan synods was as follows. The clergy, in solemn procession, came to the church assigned, at the time appointed by the bishop, and seated themselves according to the priority of their ordinations. Then the deacons and laity were admitted. The bishop, or, in his absence, the vicar, when the office for the occasion was over, made a solemn exhortation to the audience. Then a sermon was preached: after which, if the clergy had any complaints to make, or any thing else to offer, they were heard by the synod. The complaints of the clergy being over, the laity made theirs. Then the bishop proposed his diocesan constitutions to them. After which, if nothing remained to be done, he made a synodical exhortation, by way of injunction to the clergy; and all concluded with solemn prayers suited to the business. The form, at the conclusion of the first day, called *Benedictio primæ diei*, was this: *Qui dispersos Israel congregat, ipse vos hic & ubique custodiat. Amen. Et non solum vos custodiat, sed ovium suarum custodes idoneos efficiat. Amen. Ut cum summo pastore Christo de gregum suarum passione gaudeatis in coelo. Amen. Quod ipse parare dignetur, &c.* The benedictions of the other days were much to the same purpose.

The common time allowed, for dispatching the business of these synods, was three days; and a rubric was settled, to direct the proceedings in each of them. But, if the business could be dispatched in a shorter time, the assembly continued no longer than was necessary.

The first thing done, in these diocesan synods, was the bishop's making his synodical enquiries, of which the antient forms are still extant. Next the synodical causes were heard. Then the bishop reported to his clergy what had been decreed in larger provincial synods. And, lastly, he published his own diocesan constitutions, which being read, and agreed to by the synod, were from that time in force within the diocese, provided they were not contrary to the decrees of some superior council of the province. Of these we have several collections published in the volumes of the English councils, and many more are still remaining in the bishops registers.

These diocesan synods were continued in England till the reign of Henry VIII. that is, till the commencement of the reformation.

SYNODICAL, something belonging to a synod; thus synodical epistles are circular letters written by the synods to the absent prelates and churches, or even those general ones directed to all the faithful, to inform them of what had passed in the synod. For the synodical month, see the article MONTH.

SYNONYMOUS is applied to a word or term that has the same import or signification with another.

Some severe critics condemn all use of synonymous terms in the same period; but this is to condemn all antiquity: so far is the use thereof from being vicious, that it is frequently necessary; as synonyma's contribute both to the force and clearness of the expression.

SYNONYMY, *Synonymia*, in rhetoric, a figure whereby synonymous terms, that is, various words of the same signification, are used, to amplify the discourse.

The word is formed from the Greek, συν, with, and ονομα, name.

SYNOVIA, or SINOVIA, in medicine, a term used by Paracelsus, and his school, for the nutritious juice proper and peculiar to each part; thus they talk of the synovia of the joints, of the brain, &c.

Others use synovia for the gout, and other diseases of the joints, arising from a vice in the nutritious juice through a wounded part, especially a joint.

Van Helmont defines synovia a kind of transparent mucilage like seed, such as issues from the legs of a calf upon cutting off the feet.

SYNTAGMA, συνταγμα, the disposing or placing of things in an orderly manner.

SYNTAX, συνταξις, in grammar, the construction or connection of the words of a language into sentences, or phrases.

F. Buffier more accurately defines syntax, the manner of constructing one word with another, with regard to the different terminations thereof, prescribed by the rules of grammar.

Some authors, as M. Vaugelas, &c. confound syntax with style; but there is a real difference.

The office of syntax is to consider the natural suitableness of words with respect to one another, in order to make them agree in gender, number, person, mood, &c.

To offend in any of these points, is called to offend against syntax: and such kind of offence, when gross, is called a solecism; and when more slight, a barbarism.

The several parts of speech are, with regard to language, what materials are with regard to a building. How well prepared soever they may be, they will never make a house, unless they be placed conformably to the rules of architecture. It is properly the syntax that gives the form to language, and it is that on which turns the most essential part of grammar.

There are two kinds of syntax; the one of concord, wherein the words are to agree in gender, number, case, and person. The other of regimen or government, wherein one word governs another, and occasions some variations therein.

The first, generally speaking, is the same in all languages, as being the natural series of what is used almost every-where, the better to distinguish discourse. Thus, the distinction of two numbers, singular and plural, has rendered it necessary to make the adjective agree with the substantive in number: that is, to make the one singular or plural, when the other is so: for, as the substantive is the subject confusedly, though directly, marked by the adjective; if the substantive express several, there must be several subjects expressed in that form by the adjective; and, by consequence, it ought to be in the plural: as, *homines docti*, learned men: but, there being no variety of termination in the adjective, in English, to distinguish the number, it is only implied.

The distinction of masculine and feminine gender obliges the languages, which have distinct terminations, to have a concordance or agreement between the substantive and adjective, in gender as well as number: and for the same reason, the verbs are to agree with the nouns and pronouns, in number and person. If at any time we meet with any thing that seems to contradict these rules, it is by a figure of speech, that is, by having some word understood, or by considering the thoughts rather than the words themselves.

The syntax of government, on the contrary, is generally arbitrary; and, on that account, differs in most languages. One language, for instance, forms their regimen by cases; as the Latin and Greek: others use particles in lieu thereof; as the English, French, Italian, Spanish, &c.

One or two general rules, however, may be here noted, which obtain in all languages. 1. That there is no nominative case but has a relation to some verb, either expressed or understood; since we do not only speak to express what we perceive, but to express what we think of what we perceive, which is done by the verb.

2. That there is no verb but has its nominative case either expressed or understood; for the office of the verb being to affirm, there must be something to affirm of; which is the subject or nominative case of the verb; except before an infinitive, where it is an accusative; as, *Scio Petrum esse doctum*, I know Peter to be learned.

3. That there is no adjective but has a relation to some substantive; in regard the adjective marks confusedly the substantive, which is the subject of the form or quality distinctly marked by the adjective.

4. That there never comes any genitive case but what is governed by some other noun.

5. The government of verbs is frequently taken from various sorts of references, included in the cases, according to the caprice of custom or usage; which yet does not change the specific relation of each case, but only shews that custom has made choice of this or that. —Thus, the Latins say, *juvare aliquem & opitulari alicui*; the French, *servir quelqu' un et servir a quelque chose*; and, in Spanish, the generality of verbs govern indifferently a dative and an accusative case.

SYNTAXIS, in medicine, an attenuation or colliquation of the solids of the body; such as frequently happen in atrophies, inflammations of the bowels, colliquative fevers, &c. wherein a fatty, uliginous matter is voided with the excrements by stool.

SYNTHESIS, composition, or the putting of several things together: as in making a compound medicine of several simple ingredients, &c.

The word is formed from the Greek, συν, with, and θεσις, *positio*.

SYNTHESIS, in logic, denotes a branch of method opposite to analysis, called the synthetic method. See METHOD.

SYNTHESIS, in surgery, is an operation whereby divided parts are re-united, as in wounds, fractures, luxations, &c.

SYNTHETIC, or SYNTHETICAL, is, according to Dr. Shaw, a term given to that part of chemistry, which, after the analytical chemistry has taken bodies to pieces, or reduced them to their principles, can, from these separated principles, either recompound the same body again, or, from the mixtures of the principles of one or more bodies in various manners, form a large set of new productions, which would have been unknown to the world but for this art: such productions are brandy, sope, glass, and the like. Synthetical chemistry, taken in the strict sense for the recomposition of bodies from their own principles, is rather of philosophical than of ordinary use. This, however, is not easy, except in a few cases; nor are we to imagine, because it has been done in some, that nature has taken this way to compose them; her method of composition of bodies are a new subject, and worthy a diligent enquiry.

SYNUSIASTS, a sect of heretics, who maintained, that there was but one nature, and one single substance in Jesus Christ. The Synusiasts denied, that the Word assumed a body in the womb of the virgin, but held, that a part of the Divine Word being detached from the rest, was there changed into flesh and blood. Thus they taught, that Jesus Christ was consubstantial to the Father, not only as to his divinity, but even as to his humanity and very body.

SYRINGA, in botany, a plant, the flower of which has a small, tubulous, permanent empalement of one leaf, indented in four parts; it has one petal, with a long cylindrical tube, cut into four obtuse segments at the brim, which spread open, and two very short stamina, terminated by small summits, standing within the tube; it has an oblong germen, supporting a short slender style, crowned by a thick bifid stigma. The germen afterwards turns to an oblong, compressed, acute-pointed capsula, with two cells, opening with two valves contrary to the partition, including in each cell one oblong acute-pointed seed, with a membranaceous border.

There are three species of this plant, namely, 1. The syringa with oval heart-shaped leaves; or blue lilac: 2. Syringa with spear-shaped leaves, commonly called Persian jasmine. 3. The syringa with entire spear-shaped leaves, and others which are cut and jagged; commonly called cut leaved Persian jasmine.

The first sort of these plants is very common in the English gardens, where it has been long cultivated as a flowering-shrub. It is supposed to grow naturally in some parts of Persia, but is so hardy as to resist the greatest cold of this country. There are three varieties of this shrub. which are commonly cultivated in the English gardens, which differ in the colour of their flowers, and also in that of their shoots and leaves; one of these has white flowers, one blue, and the third has purple flowers; the latter is commonly known by the title of Scotch lilac, to distinguish it from the other. This is the most beautiful of the three, and is probably called the Scotch lilac, because it was first mentioned in the catalogue of the Edinburgh garden.

These shrubs grow to the height of eighteen or twenty feet in good ground, and divide into many branches; those of the white sort grow more erect than the other, and the purple or Scotch lilac has its branches more diffused than either. The branches of the white are covered with a smooth bark, of a grey colour; those of the other two are darker. The leaves of the white are of a very bright green, but those of the other are of a dark green; their shape and size are so near as not to be distinguished thereby. They are heart-shaped, and are placed opposite. The buds of the future shoots, which are very turgid before the leaves fall, are of a very bright green

green in the white ſort, but thoſe of the other two are of a dark green. The flowers are always produced at the ends of the ſhoots of the former year, and below the flowers come out ſhoots to ſucceed them; for that part upon which the flowers ſtand, decays down to the ſhoots below every winter. There are generally two bunches or panicles of flowers joined at the end of each ſhoot; thoſe of the blue are the ſmalleſt, and are placed thinner than either of the other. The bunches on the white are larger; the flowers are cloſer placed, and larger than the blue; but thoſe of the Scotch are larger, and the flowers are fairer than thoſe of either of the other, ſo make a much finer appearance. The panicles of flowers grow erect, and being intermixed with the fine green leaves, have a fine effect; and if we add to this the fragrancy of their flowers, it may be ranged among the moſt beautiful ſhrubs which now decorate the Engliſh gardens. They flower in May, and when the ſeaſon is cool, theſe ſhrubs will continue three weeks in beauty, but in hot ſeaſons the flowers ſoon fade. Their ſeeds are ripe in September, which, if ſown ſoon after, the plants will come up the following ſpring; but as their roots ſend out great plenty of ſuckers annually, ſo few perſons ever take the trouble to propagate theſe plants by ſeeds. I have raiſed ſeveral plants of the three ſorts from ſeeds, and conſtantly found them prove the ſame as the ſhrubs from which the ſeeds were taken. Theſe plants do generally flower the third year from ſeed; and I have always found theſe plants not ſo apt to ſend out ſuckers, as thoſe which were produced by ſuckers, ſo are much more valuable; for the others put out ſuch plenty of ſuckers, as that if they are not annually taken from the plants, they will ſtarve them.

Theſe plants thrive beſt upon a light rich ſoil, ſuch as the gardens near London are for the moſt part compoſed of; and there they grow to a much larger ſize, where they are permitted to ſtand unremoved, than in any other part of England; for in ſtrong loam, or upon chalky land, they make little progreſs. If the ſuckers are ſmall when they are taken from the old plants, they ſhould be planted in a nurſery, in rows, three feet aſunder, and one foot diſtance in the rows, where they may ſtand a year or two to get ſtrength, and then they ſhould be removed to the places where they are to remain. The beſt time to tranſplant theſe ſhrubs is in autumn.

The ſecond ſort grows naturally in Perſia, but has been long cultivated in the Engliſh gardens, where it is beſt known among the gardeners by the name of Perſian jaſmine. This is a ſhrub of much lower growth than the former, ſeldom riſing more than ſix or eight feet high. The ſtalks of this ſhrub are woody, covered with a ſmooth brown bark; the branches are ſlender, pliable, and extend wide on every ſide; theſe frequently bend downward where they are not ſupported; they are garniſhed with narrow ſpear-ſhaped leaves, placed oppoſite, of a deep green colour, ending in acute points. The flowers are produced in large panicles at the end of the former year's ſhoots, in like manner as the former; they are of a pale purple colour, and have a very agreeable odour. Theſe appear the latter end of May, ſoon after thoſe of the common ſort, and continue longer in beauty; but theſe do not perfect their ſeeds in England.

The third ſort differs from the ſecond in having two ſorts of leaves; thoſe on the lower part of the branches are for the moſt part entire; theſe are broader and ſhorter than thoſe of the ſecond, and do not end in ſo ſharp points. The leaves on the younger branches are cut into three or five ſegments, like winged leaves almoſt to the mid rib. The branches of this ſort are ſlender and weaker than thoſe of the ſecond; their bark is of a darker brown, and the flowers of a brighter purple colour.

This was brought into Europe before the other, and came by the Perſian title Agem. Both theſe ſorts are uſually propagated by ſuckers, which their roots ſend out in great plenty; theſe ſhould be carefully taken off from the old plants in the autumn, and planted in a nurſery in the ſame manner as is before directed for the firſt, where they may grow two years to get ſtrength, and may then be tranſplanted to the places where they are deſigned to remain. The plants which are ſo propagated are always very prolific in ſuckers; for which reaſon it will be a better way to raiſe them by laying down their young branches, which in one year will be ſufficiently rooted to tranſplant, and may be treated in the ſame way as the ſuckers. *Miller's Gard. Dict.*

SYRINGE, an inſtrument ſerving to imbibe, or ſuck up, a quantity of any fluid, and ſo ſquirt or expel the ſame with violence.

The word is formed from the Greek συριγξ, or Latin *ſyrinx*, pipe.

SYRUP, or SYROP, in pharmacy, is a liquid form of medicine, prepared of decoctions, juices, or infuſions, preſerved by means of honey or ſugar, and reduced to ſuch a conſiſtence, that a drop let fall on a marble does not ſpread.

Syrups, like other officinal preparations, may be made to anſwer various intentions, and conſequently, may be either of a cooling, heating, drying, inciding, expectorating, incraſſating, diuretic, ſudorific, lithontriptic, alexiterial, or corroborating quality, according to the different virtues of the general rules for the making of ſyrups.

1. The ſugar, employed for ſyrups made without coction, ſhould firſt be boiled with water to a candy conſiſtence; obſerving to clarify it with the whites of eggs, and by deſpumation. But the whiteſt and pureſt ſugar, and ſugar-candy, do not require this labour. The ſugar thus prepared ought afterwards to be powdered, that it may diſſolve the eaſier.

2. Though a double weight of ſugar, in proportion to the liquor, may be required in making ſuch ſyrups; yet a leſs proportion will generally ſuffice. Firſt, therefore, diſſolve only an equal quantity of ſugar; then, by degrees, add a little more in powder, till it remain undiſſolved, at the bottom, to be afterwards incorporated by the gentle heat of a water bath.

3. Acid ſyrups, or thoſe made with the juices of fruits, ſhould not be put into copper veſſels, unleſs ſuch as are tinned.

4. What ſhould be obſerved of decoctions in general, is alſo to be underſtood of decoctions for ſyrups. The vegetables, uſed either for decoctions or infuſions, are to be moderately dried, unleſs they are expreſsly required freſh gathered.

5. Syrups made by coction are to be clarified with the white of eggs, except diacodium; which, therefore, requires the pureſt ſugar.

The ſolutive and purging ſyrups ought rather to be made of brown ſugar.

SYSSARCOSIS, in anatomy, a particular ſpecies of the kind of articulation, called alſo ſymphyſis.

The ſyſſarcoſis is a natural union of two bones by means of fleſh or muſcles, ſuch is that of the os hyoides and omoplate.

Syſſarcoſis is alſo uſed by ſome chirurgical writers to expreſs a method of curing wounds of the head when the cranium is laid bare, and the interſtice between the lips of the wound too wide for a contraction, by means of promoting the granulation or growth of new fleſh

SYSTEM, *Syſtema*, in general denotes an aſſemblage or chain of principles and concluſions, or the whole of any doctrine, the ſeveral parts whereof are connected together and follow or depend on each other; in which ſenſe we ſay, a ſyſtem of philoſophy, a ſyſtem of divinity, &c.

SYSTEM, in aſtronomy, denotes an hypotheſis or ſuppoſition of a certain order, and arrangement of the ſeveral parts of the univerſe; whereby aſtronomers explain all the phænomena or appearances of the heavenly bodies, their motions, changes, &c.

The moſt celebrated hypotheſes, or ſyſtems of the world, are three, viz. the Ptolemaic, Tychonic, and Pythagorean, or Copernican ſyſtem.

Ptolemaic SYSTEM, ſo called from its inventor, Claudius Ptolemæus, a famous aſtronomer of Peluſium, in Egypt, ſuppoſes the earth immoveably fixed in the center, not of the world only, but of the univerſe; and that the ſun, the moon, the planets, and ſtars, all

moved

moved about it from east to west once in 24 hours, in the order following, viz. the moon, Mercury, Venus, the sun, Mars, Jupiter, Saturn, the fixed stars; and, above all, the figment of their primum mobile, or the sphere which gave motion to all the rest. See a representation of this system, plate CXXV. *fig.* 1.

This system was first invented and adhered to, chiefly, because it seemed to correspond with the sensible appearances of the celestial motions. They took it for granted, that the motions which those bodies appeared to have, were such as they truly and really performed; and not dreaming of any motion in the earth, nor being apprised of the distinction of absolute, relative, or apparent motion, they could not make a proper judgment of such matters, but were under a necessity of being misled by their very senses, for want of proper assistance which after-ages produced.

It is easy to observe, they had no notion of any other system but our own, nor of any other world but the earth on which we live. They thought nothing less than that all things were made for the use of man; that all the stars were contained in one concave sphere, and, therefore, at an equal distance from the earth; and that the primum mobile was circumscribed by the cœlum empyreum of a cubic form, which they supposed to be the heaven, or blissful abode of departed souls.

It would scarce have been worth while to have said so much about so absurd an hypothesis (as this is now well known to be) were it not that there are still numerous retainers thereto, who endeavour very zealously to defend the same, and that for two reasons principally, viz. because the earth is apparently fixed in the center of the world, and the sun and stars move about it daily; and, also, because the scripture asserts the stability of the earth, the motion of the sun, &c.

These two arguments merit no particular answer. It is sufficient, with respect to the first, to say, that we are assured things may (nay must) appear to be, in many cases, what they really are not, nay, to have such affections and properties as are absolutely contrary to what they really possess. Thus a person sitting in the cabbin of a ship under sail, will, by looking out at the window, see an apparent motion of the houses, the trees, &c. on the strand, the contrary way, but will perceive no motion at all in the ship. Also, a person sitting in a windmill, if the mill be turned about, he will see an apparent motion of the upright post the contrary way, but will not perceive any in the mill itself.

All those cases are exactly parallel to that of the earth; and it is as rational to assert the ship and the mill are really quiescent, and the other bodies positively in motion, as it is to insist on the motion of the sun, and the earth's being at rest in the center.

As to the scripture, as it was never intended for an institution of astronomy or philosophy, so nothing is to be understood as strictly or positively asserted in relation thereto, but as spoken only agreeably to the common phrase, or vulgar notion, of things. And thus Sir Isaac Newton himself would always say, the sun rises, and the sun sets; and would have said with Joshua, "Sun, stand thou still," though he well knew it was quite contrary in the nature of the thing.

Tychonic SYSTEM.—This is represented plate CXXV. *fig.* 2. It owes its origin to Tycho Brahe, a nobleman of Denmark, who lived in the latter part of the last century; he made his observations at Uraniburg (i. e. celestial tower) in the island of Weer or Huena. This philosopher, though he approved of the Copernican system, yet could he not reconcile himself to the motion of the earth; and being, on the other hand, convinced the Ptolomean scheme, in part, could not be true, he contrived one different from either, which is represented by the diagram referred to.

In this the earth has no motion allowed it, but the annual and diurnal phænomena are solved by the motion of the sun about the earth, as in the Ptolomaic scheme; and those of Mercury and Venus are solved by this contrivance, though not in the same manner, so simply and naturally, as in the Copernican system; as is easy to observe in the figure.

After this scheme, had been proposed some time, it received a correction, by allowing the earth a motion about its axis, to account for the diurnal phænomena of the heavens; and so this came to be called the semi-Tychonic system. But this was still wide of the truth, and encumbered with such hypotheses, as the true mathematician and genuine philosopher could never relish.

Copernican SYSTEM. See the article COPERNICAN *System*.

SYSTEM, in poetry, implies a certain hypothesis, or scheme, of religion, from which the poet is never to recede.

SYSTEM, in music, signifies a compound interval; or an interval composed, or conceived to be composed, of several lesser intervals.—Such as the octave, &c.

The concinnous systems are those consisting of such parts as are fit for music, and those placed in such an order between the extremes, as that the succession of sounds from one extreme to another, may have a good effect.

Inconcinnous systems are those where the simple intervals are inconcinnous, or ill-disposed, betwixt the extremes.

SYSTOLE, in anatomy, the contraction of the heart, whereby the blood is drawn out of its ventricles into the arteries; the opposite state to which is called the diastole, or dilatation of the heart.

The systole of the heart is well accounted for by Dr. Lower, who shews that the heart is a true muscle, the fibres of which are acted on like those of other muscles, by certain branches of the eight pair of nerves inserted into it, which bring the animal spirits from the brain hither. By a flux of these spirits the muscular fibres of the heart are inflated and thus shortened, the length of the heart diminished, its breadth or thickness increased, the capacity of the ventricles closed, the tendinous mouths of the arteries dilated, those of the veins shut up by means of their valves, and the contained juice forcibly expressed in the orifices of the arteries.

Dr. Drake adds to Dr. Lower's account, that the intercostal muscles and diaphragm contribute to the systole, by opening the blood a passage from the right ventricle of the heart to the left, through the lungs, to which it could not otherwise pass, because the opposition the blood contained in that ventricle must necessarily have made to its constriction, is taken off. Both these authors make the systole the natural state, or action of the heart, and the diastole the violent one. Boerhaave, on the contrary, makes the systole the violent, and the diastole the natural state.

SYSTYLE, in architecture, that manner of placing columns where the space between the two first consist of two diameters, or four modules.

SYZYGY, in astronomy, a term equally used for the conjunction and opposition of a planet with the sun.

The word is formed from the Greek, *συζυγια*, which properly signifies conjunction.

On the phænomena and circumstances of the syzygies, a great part of the lunar theory depends. See MOON.

T.

TAB

T a conſonant, and the nineteenth letter in the alphabet. The letter T was in the ſame form T, in the old Greek alphabet, and was derived from the Phœnician or Samaritan character Tau ✝, by placing the horizontal line or ſtroke quite upon the top of the perpendicular one. It is formed in the voice from a ſtrong expulſion of the breath through the mouth, upon a ſudden detraction of the tongue from the fore part of the palate, with the lips at the ſame time open.

T, has its proper ſound in *tan*, *tin*, *ten*, *ton*, *tun*, *fat*, *let*, *hit*, *hot*, *put*. When it comes before (i) followed by another vowel, it is ſounded like S, as in *nation*, *potion*, *expiate*, &c. When aſpirated, that is, when *h* comes after it, it has a twofold ſound; one clear and acute, as *thin*, *theory*, &c. the other more obſcure and obtuſe, as in *thine*, *thoſe*, *their*, &c. It is ſaid by ſome, that T ſounds like *ch* before *eous*, *ous*, *uous*; as in *beauteous*, *portentous*, *tortuous*; but this ſeems a vicious pronunciation.

Among the ancients, T, as a numeral, ſtood for one hundred and ſixty; and with a daſh at the top, thus $\overline{T}$, it ſignified one hundred and ſixty thouſand.

When the tribunes approved of the decrees of the ſenate, they teſtified their conſent by ſubſcribing a T.

In muſic, T, ſtands for tutti, all, or altogether.

T, or TAU, in heraldry, is a kind of croſs patent, or truncated; found in all the armories of the commanders of the order of St. Anthony,

TABBY, in commerce, a kind of rich ſilk which has undergone the operation of tabbying.

TABBYING, the paſſing a ſilk or ſtuff under a calender, the rolls of which are made of iron or copper, variouſly engraven, which bearing unequally on the ſtuff renders the ſurface thereof unequal, ſo as to reflect the rays of light differently, making the repreſentation of waves thereon.

TABELLA, TABLET, in pharmacy, is much the ſame with troches and lozenges, being a ſolid preparation formed into a little cake, or maſs, of different figures, intended to diſſolve ſlowly, and generally made agreeable to the palate. This form is moſtly made uſe of for the more commodious exhibition of certain medicines, by fitting them to diſſolve ſlowly in the mouth ſo as to paſs by degrees into the ſtomach; and hence theſe preparations have generally a conſiderable proportion of ſugar or other ſuch materials. They are calculated for children who are not eaſily prevailed on to take medicines in leſs agreeable forms. There are various kinds of them, as the tabellæ antacidæ, tabellæ anthelminticæ, tabellæ purgantes, &c.

TABERNACLE, among the Hebrews, a kind of building, in the form of a tent, ſet up, by expreſs command of God, for the performance of religious worſhip, ſacrifices, &c. during the journeying of the Iſraelites in the wilderneſs; and, after their ſettlement in the land

TAB

of Canaan, made uſe of for the ſame purpoſe till the building of the temple of Jeruſalem. It was divided into two parts, the one covered, and properly called the tabernacle; and the other open, called the court. The curtains which covered the tabernacle were made of linen, of ſeveral colours, embroidered. There were ten curtains, twenty-eight cubits long and four in breadth. Five curtains faſtened together made up two coverings, which covered all the tabernacle. Over theſe there were two other coverings; the one of goat-hair, and the other of ſheep-ſkins. The holy of holies was parted from the reſt of the tabernacle by a curtain made faſt to four pillars, ſtanding ten cubits from the end. The length of the whole tabernacle was thirty-two cubits, that is, about fifty feet; and the breadth twelve cubits, or nineteen feet. The court was a ſpot of ground one hundred cubits long, and fifty in breadth, encloſed by twenty columns, each twenty cubits high and ten in breadth, covered with ſilver, and ſtanding on copper baſes, five cubits diſtant from one another; between which, there were curtains drawn, and faſtened with hooks. At the eaſt end was an entrance, twenty cubits wide, covered with a curtain hanging looſe.

The tabernacle was finiſhed, and ſet up on the firſt day of the firſt month of the ſecond year, after the departure out of Egypt. When it was ſet up, a dark cloud covered it by day, and a fiery cloud by night. Moſes went into the tabernacle to conſult the Lord. It was placed in the midſt of the camp, and the Iſraelites were ranged orderly about it, according to their ſeveral tribes. When the cloud aroſe from off the tabernacle, they decamped; the prieſts carried thoſe things which were ſacred, and the Levites all the ſeveral parts of the tabernacle. Part of the tribes went before, and the reſt followed; and the baggage of the tabernacle marched in the center.

The learned Spencer has endeavoured to prove, that the Jewiſh tabernacle, and all its furniture, was an imitation of the portable temples of the heathens, and of the cuſtom of carrying their gods along with them, in their migrations from one country to another.

Feaſt of TABERNACLES, a ſolemn feſtival of the Hebrews, obſerved after harveſt, on the fifteenth day of the month Tiſri, inſtituted to commemorate the goodneſs of God, who protected the Iſraelites in the wilderneſs, and made them dwell in booths, when they came out of Egypt. On the firſt day of the feaſt, they began to erect booths of the boughs of trees; and in theſe they were obliged to continue ſeven days. The booths were placed in the open air, and were not to be covered with cloths, nor made too cloſe by the thickneſs of the boughs; but ſo looſe that the ſun and the ſtars might be ſeen, and the rain deſcend through them. In theſe they eat, and drank, and ſlept, during the continuance of the feſtival. But ſick perſons who could not bear the ſmell of the earth, might ſtay at home: the rabbins alſo freed women and

little children from this obligation. If the rain likewiſe proved ſo great that they could not live dry, or the cold ſo intenſe that it endangered their healths, they might all return to their houſes.

In the time of Nehemiah, they made their booths, ſome upon the roofs of their houſes, which were flat, ſome in their court-yards, and ſome in the ſtreets.

The command, in the law, concerning the boughs and branches of trees to be uſed in this feſtival, being expreſſed in a general way, "Ye ſhall take unto you, upon the firſt day, boughs of goodly trees," there aroſe a diſpute between the Phariſees and the Sadducees, for what end theſe boughs and branches were appointed. The Sadducees held that they were for making of the booths; but the Phariſees determined that theſe were branches and fruit of trees, that they were to carry in their hands at this feſtival.

Upon the firſt day of the feaſt, therefore, they prepared branches of palm, willow, and myrtle, and tied them together with gold or ſilver twiſt, or with other ſtrings or twigs; and theſe they carried in their hands all the time of the feaſt. Once every day, they came into the court of the temple and walked round the altar, and held their boughs bending towards it; and cried Hoſanna, or "Save now, O Lord; O Lord, ſend us now proſperity." Upon the ſeventh day, they compaſſed the altar ſeven times; this was called the great Hoſanna; and every day, when they went away, they ſaid, "Beauty be to thee, O altar! Beauty be to thee, O altar!

The ceremony of drawing, and pouring out of water gave them the greateſt joy and delight, of any that belonged to this feſtival; inſomuch that the Talmudiſts have this noted ſaying. "He who never ſaw the rejoicing of drawing water, never ſaw rejoicing in all his life." The manner was thus: When the parts of the daily ſacrifice were laid upon the altar, one of the prieſts, with a golden veſſel, went to the fountain of Siloam, and there filled it with water. He returned back into the court, through the water-gate; and when he came there, the trumpets ſounded. Then he went up to the riſe of the altar, where ſtood two baſons, one having wine in it; and into the other he poured the water: next he poured either the wine into the water, or the water into the wine, and laſtly poured them out mixed together by way of libation.

This cuſtom is ſuppoſed to be alluded to by our Saviour, when he cried, upon the laſt and great day of the feaſt, "If any man thirſt, let him come unto me and drink, &c." It is difficult to find a tolerable reaſon for this practice at the feaſt of tabernacles, eſpecially ſince the Jewiſh writers afford no ſatisfaction concerning it. Probably it might be done in memory of that water, which followed the Iſraelites, all the time they were in the wilderneſs, without which they muſt have periſhed.

After the ſervice of the daily ſacrifice were offered the additional ſacrifices, which, with the daily ſacrifices of the time, amounted to two hundred and fifteen, the number of years that the Iſraelites continued in Egypt. At this feſtival all the four and twenty courſes of the prieſts attended; and it was ſo managed, that every courſe ſhould have a ſhare in offering one beaſt or other every day till the ſolemnity ended.

At the offering of theſe additional ſacrifices there were peculiar pſalms ſung by the Levites; and when theſe ſacrifices were finiſhed, the people went home to dinner, after they had ſung their Hoſanna about the altar, with their palms in their hands. After dinner, they uſually ſpent ſome time in the divinity-ſchools, or in the ſtudy of the law, till the time of the evening ſacrifice.

About night, they began their rejoicing for the pouring out of water. For this purpoſe, they went into the court of the women, who were placed in balconies round about the court.

Here the Levites, with their harps, pſalteries, cymbals, and other inſtruments, began to play. In the mean time, the elders of the people, the members of the Sanhedrim, rulers of the ſynagogues, doctors of the ſchools, and all who were diſtinguiſhed by the dignity of their office, fell a dancing, leaping, and capering, ſinging ſongs and doxologies, with lighted torches in their hands; and this wild ſort of devotion held for the greateſt part of the night. At laſt, when the night was far advanced, two prieſts, ſtanding in the gate of Nicanor, blew their trumpets; and this concluded the ſolemnity.

TABERNÆMONTANA, in botany, a genus of plants, the flower of which has a ſmall empalement, cut into five acute parts; it has one funnel ſhaped petal, with a long cylindrical tube, which is bellied at both ends, and at the brim is cut into five oblique ſegments; it has five ſmall ſtamina in the middle of the tube, terminated by ſummits which join together, and two germen, ſupporting an awl-ſhaped ſtyle, crowned by decayed ſtigmas. The germen afterward turns to two bellied capſules, which are horizontally reflected, opening with one valve, having one cell, filled with oblong oval ſeeds, and ſurrounded with pulp.

There are two ſpecies of this plant. 1. Tabernæmontana with ſpear-ſhaped leaves, which are placed oppoſite, and flowers growing in a corymbus on the ſides of the branches. 2. Tabernæmontana with oblong, oval, acute pointed leaves, which are placed oppoſite, and flowers growing in a corymbus, terminating the branches.

The firſt ſort grows naturally in Jamaica, and ſome of the other iſlands in the Weſt-Indies. This riſes with an upright woody ſtalk to the height of fifteen or ſixteen feet, covered with a ſmooth grey bark, which abounds with a milky juice, and ſends out ſeveral branches from the ſide, which grow erect, garniſhed with thick leaves, which have a milky juice, of a lucid green, and have many tranſverſe veins from the midrib to the border, ſtanding oppoſite on foot ſtalks an inch long. The flowers come out in roundiſh bunches from the wings of the ſtalk; they are ſmall, of a bright yellow colour, and have an agreeable odour. The tube of the flower is half an inch long; the brim is cut into five acute points, which ſpread open like thoſe of the common jaſmine. Theſe flowers, in their native ſoil, are ſucceeded by two ſwelling capſules, joined at their baſe, but ſpread from each other horizontally, and are filled with oblong ſeeds, lying over each other like the ſcales of fiſh, and are included in a ſoft pulp.

The ſecond ſort was diſcovered by the late Dr. William Houſtoun, in the year 1730, growing naturally at La Vera Cruz. This riſes with a woody ſtalk ten or twelve feet high, covered with a wrinkled grey bark, ſending out many branches towards the top, which are garniſhed with oblong oval leaves, of a lucid green, and of a thick conſiſtence; they are five inches long and two and a half broad, rounded at both ends, but terminate with an acute point. Theſe are placed oppoſite, and have ſhort foot-ſtalks. The flowers come out in pretty large roundiſh bunches at the end of the branches; they are white, and ſmaller than thoſe of the firſt ſort, having an agreeable ſcent. Theſe are ſucceeded by ſhorter and rounder pods, which ſpread from each other horizontally like the former.

Both theſe plants are very impatient of cold, ſo will not live in this country unleſs they are placed in a warm ſtove. They may be propagated by ſeeds or cuttings; if by ſeeds, they may be procured from the countries where the plants grow naturally; theſe ſhould be ſown early in the ſpring on a hot-bed, and when the plants are come up, they muſt be carefully tranſplanted into ſmall pots, filled with light rich earth, and plunged into a hot-bed of tanners bark, being careful to ſhade them in the heat of the day, until they have taken new root; after which time they muſt have free air admitted to them every day when the weather is warm; but if the nights ſhould prove cold, the glaſſes of the hot-bed ſhould be covered with mats every evening, ſoon after the ſun goes off from the bed. Theſe plants muſt be often refreſhed with water, but it muſt not be given to them in large quantities, eſpecially while they are young; for as they are full of a milky juice, they are very ſubject to rot with much moiſture.

The plants may remain during the ſummer ſeaſon in the hot-bed, provided the tan is ſtirred up to renew the heat when it wants, and a little new tan added; but at Michaelmas, when the nights begin to be cold, the

plants ſhould be removed, and plunged into the bark-bed in the ſtove; where, during the winter ſeaſon, they muſt be kept in a moderate degree of warmth, and in cold weather they ſhould have but little water given them. As theſe plants are too tender to live in the open air in this country, they ſhould conſtantly remain in the ſtove, where, in warm weather, they may have free air admitted to them, by opening the glaſſes; but in cold weather they muſt be kept warm. With this management the plants will thrive and produce their flowers; and as their leaves are always green, they will make a pleaſant diverſity amongſt other tender exotic plants in the ſtove.

Theſe plants may alſo be propagated by cuttings during the ſummer ſeaſon, which ſhould be cut off from the old plants, and laid to dry in the ſtove five or ſix days before they are planted, that the wounded parts may heal, otherwiſe they will rot. Theſe cuttings ſhould be planted in pots filled with freſh light earth and plunged into the hot-bed of tanners bark, and cloſely covered with a hand-glaſs, obſerving to ſhade them from the ſun in the middle of the day in hot-weather, as alſo to refreſh them now and then with a little water. When the cuttings have taken root, they may be tranſplanted into ſeparate pots, and treated in the ſame manner as thoſe which are raiſed from ſeeds.

TABES, in medicine, or TABES DORSALIS, ariſes from a diſorder of the ſpinal marrow, and is principally incident to perſons of a ſalacious diſpoſition, or ſuch as are newly married. The patients are free from a fever, eat and digeſt well. The perſon labouring under this diſorder, when interrogated with reſpect to his ſtate, affirms, that he perceives, as it were, ants falling from the ſuperior part of his body, his head, for inſtance, into the ſpine of the back; and, when he diſcharges his urine or excrements, there is, at the ſame time, a copious evacuation of liquid ſemen, in conſequence of which, he is incapable of propagating his ſpecies, anſwering the purpoſes of marriage, or being amuſed with venereal dreams. He is generally ſhort-breathed and weak, eſpecially after running, or walking up a ſteep place; he perceives a ſenſe of weight in his head, and is afflicted with a ringing of his ears. The patient is, in proceſs of time, ſeized with various ſpecies of violent fevers, and at laſt dies of that kind of fever called lipyria.

This efflux of the nutritious juice being once ſtopped by art, the diſpirited and impoveriſhed blood muſt be repleniſhed, as ſoon as may be, with new chyle, by ſuch food as is delicious, and affords a good juice, and is moſt grateful to the patient's ſtomach; muſt be given often in a day, though in a little quantity at a time. And that the appetite may be the more excited, let him be adviſed to be chearful; for there is nothing deſtroys the appetite, and confirms a conſumption, more than grief or ſadneſs. Let him alſo enjoy the benefit of the open air, which is beneficial to the nerves, and, conſequently, to the appetite and ſtomach. But he muſt religiouſly abſtain from wine and ſpirituous liquors, which are ſubject to put the blood, which before was too hot, into a greater flame. No purges are to be uſed to procure any other conſiderable evacuation, which may create farther expences to nature, when ſhe is already weak.

TABLATURE, in anatomy, a diviſion or parting the ſkull into two tables.

TABLE, in architecture, a ſmooth, ſimple member or ornament of various forms, but moſt uſually in that of a long ſquare.

A projecting table is that which ſtands out from the naked of the wall, pedeſtal, or other matter it adorns.

Raked-table, is that which is hollow in the die of a pedeſtal, or elſewhere, and is uſually encompaſſed with a moulding.

Razed-table, is an emboſſment in a frontiſpiece for the putting an inſcription, or other ornament, in ſculpture. This is what M. Perrault underſtands by abacus in Vitruvius.

Crowned-table, that which is covered with a corniche, and in which a baſſo relievo is cut, or a piece of black marble incruſtated for an inſcription.

Ruſticated-table, that which is picked, and whoſe ſurface ſeems rough, as in grottos, &c.

TABLE, in perſpective, denotes a plain ſurface, ſuppoſed to be tranſparent, and perpendicular to the horizon. It is always imagined to be placed at a certain diſtance between the eye and the objects, for the objects to be repreſented thereon by means of the viſual rays paſſing from every point thereof through the table to the eye; whence it is called perſpective-plane.

TABLE, in anatomy. The cranium is ſaid to be compoſed of two tables, or laminæ, i. e. it is double, as if it conſiſted of two bones laid over one another.

TABLE *of Pythagoras*, or *Multiplication* TABLE. See MULTIPLICATION.

Laws of the twelve TABLES, were the firſt ſet of laws of the Romans, thus called either by reaſon the Romans then wrote with a ſtyle on thin wooden tablets covered with wax, or rather, becauſe they were engraven on tables, or plates, of copper, to be expoſed in the moſt noted part of the public forum. After the expulſion of the kings, as the Romans were then without any fixed or certain ſyſtem of law, at leaſt had none ample enough to take in the various caſes that might fall between particular perſons, it was reſolved to adopt the beſt and wiſeſt laws of the Greeks. One Hermodorus was firſt appointed to tranſlate them, and the decemviri afterwards compiled and reduced them into ten tables. After a world of care and application, they were at length enacted and confirmed by the ſenate and an aſſembly of the people, in the year of Rome 303. The following year they found ſomething wanting therein, which they ſupplied from the laws of the former kings of Rome, and from certain cuſtoms which long uſe had authoriſed; all theſe being engraven on two other tables made the laws of the twelve tables, ſo famous in the Roman juriſprudence, the ſource and foundation of the civil or Roman law.

TABLES *of the Law*, in Jewiſh antiquity, two tables on which were written the Decalogue, or Ten Commandments, given by God to Moſes on Mount Sinai.

Many queſtions have been ſtarted about theſe tables, as concerning their matter, form, number, author, and contents. Some ſuppoſe them to have been made of wood, others of precious ſtone. Theſe again are divided; ſome ſuppoſing them to have been of ruby, and others of carbuncle. Some oriental authors pretend they were ten in number, and others ſeven, but the Hebrews acknowledge no more than two. Moſes obſerves, that theſe tables were written on both ſides: many think they were tranſparent, ſo that they might be read through: others are of opinion that the ſame Ten Commandments were written on each of the two tables; and others, that the ten were divided, five being written on one table and five on the other. Moſes expreſly ſays that theſe tables were written by the hand of God. Some underſtand this literally, others aſcribe it to the miniſtry of an angel, and others explain it by an order of God to Moſes himſelf, to write them. The Mahometans ſay that God commanded the archangel Gabriel to make uſe of the pen, which is the invocation of the name of God, and of the ink which is taken out of the river of light, and therewith to write the tables of the law. When Moſes brought theſe tables down from the mount, and ſaw the idolatry into which the children of Iſrael had fallen, he dropt them out of his hand, and by the fall they were broken to pieces; but this loſs was repaired by the ſecond table which God gave to Moſes, and in which he commanded him to write down the words of the covenant which he had made with Iſrael. From hence ſome conclude that theſe latter tables were not written by the hand of God, though the firſt were. But Moſes takes expreſs notice that God himſelf wrote them; whence it follows either that they were both written by the finger of God, or that neither of them was ſo written.

New TABLES, *Tabulæ novæ*, an edict occaſionally publiſhed in the Roman commonwealth, for the aboliſhing all kinds of debts and annulling all obligations.

TABLE, among the jewellers. A table diamond, or other precious ſtone, is that whoſe upper ſurface is quite flat, and only the ſides cut in angles; in which ſenſe a diamond,

diamond, cut table-wiſe, is uſed in oppoſition to a roſe-diamond.

TABLE is alſo uſed for an index or repertory put at the beginning or end of a book, to direct the reader to any paſſage he may have occaſion for: thus we ſay table of matters, table of authors quoted, &c. Tables of the Bible are called Concordances.

TABLE *of Houſes*, among aſtrologers, certain tables ready drawn up for the aſſiſtance of practitioners in that art, for the erecting or drawing of figures or ſchemes.

TABLE, in mathematics, a ſyſtem of numbers calculated to be ready at hand for the expediting aſtronomical, geometrical, and other operations: thus we ſay, tables of the ſtars; tables of ſines, tangents, and ſecants; tables of logarithms, rhumbs, &c. ſexagenary tables; loxodromic tables, &c.

Aſtronomical TABLES, are computations of the motions, places, and other phænomena of the planets, both primary and ſecondary.

The oldeſt aſtronomical tables are the Ptolemaic, found in Ptolemy's Almageſt; but theſe no longer agree with the heavens.

In 1252, Alphonſo XI. king of Caſtile, undertook the correcting them, chiefly by the aſſiſtance of Iſaac Hazan, a Jew; and ſpent four hundred crowns therein. Thus aroſe the Alphonſine tables, to which that prince himſelf prefixed a preface. But the deficiency of theſe was ſoon perceived by Purbachius and Regiomontanus; upon which the latter, and after him Waltherus and Warnerus, applied themſelves to cœleſtial obſervation, for the further amending them; but death prevented any progreſs therein.

Copernicus, in his books of the cœleſtial revolutions, inſtead of the Alphonſine tables, gives others of his own calculation, from the latter, and partly from his own obſervations.

From Copernicus's obſervations and theories, Eraſ. Reinholdus afterwards compiled the Prutenic tables, which have been printed ſeveral times, and in ſeveral places.

Tycho Brahe, even in his youth, became ſenſible of the deficiency of the Prutenic tables; which was what determined him to apply himſelf with ſo much vigour to cœleſtial obſervation. Yet all he did thereby, was to adjuſt the motions of the ſun and moon; though Longomontanus, from the ſame, to the theories of the ſeveral planets publiſhed in his Aſtronomia Danica, added tables of their motions, now called the Daniſh Tables; and Kepler likewiſe, from the ſame, in 1627, publiſhed the Rudolphine Tables, which are now much eſteemed. Theſe were afterwards, in the year 1650, turned into another form, by Maria Cunitia, whoſe aſtronomical tables, comprehending the effect of Kepler's phyſical hypotheſis, are exceedingly eaſy, and ſatisfy all the phœnomena, without any trouble of calculation, or any mention of logarithms; ſo that the Rudolphine calculus is here greatly improved.

Mercator made a like attempt in his Aſtronomical Inſtitutions, publiſhed in 1676; and the like did J. Bap. Morini, whoſe abridgement of the Rudolphine tables was prefixed to a Latin verſion of Street's Aſtronomia Carolina, publiſhed in 1705.

Lanſbergius, indeed, endeavoured to diſcredit the Rudolphine tables, and framed perpetual tables, as he calls them, of the heavenly motions; but his attempt was never much regarded by the aſtronomers; and our countryman Horrox gave an abundant check to his arrogance, in his Defence of the Keplerian Aſtronomy.

Nor was the authority of the Rudolphine tables impaired by the Philolaic tables of Bullialdus's hypotheſis; or the Britannic tables of Newton; or the French ones of the count de Pagan, or the Caroline tables of Street, all calculated on Dr. Ward's hypotheſis, or the Novalmageſtic tables of Ricciolus. Among theſe, however, the Philolaic and Caroline tables are eſteemed the beſt; inſomuch that Mr. Whiſton, by the advice of Mr. Flamſteed, a perſon of undoubted authority in ſuch caſes, thought fit to ſubjoin the Caroline tables to his Aſtronomical Lectures.

The Ludovician tables were publiſhed in 1702, by M. de la Hire, wholly from his own obſervations, and without the aſſiſtance of any hypotheſis; which, before the invention of the micrometer, teleſcope, and the pendulum-clock, was held impoſſible. But the lateſt, and much the beſt, are thoſe of the celebrated Dr. Halley.

TABOR, *Tabourin*, a ſmall drum.

TABORITES, or THABOUTS, a branch or ſect of the antient Huſſites. They carried the point of reformation farther than Huſs had done, rejected purgatory, auricular confeſſion, the unction of baptiſm, tranſubſtantiation, &c. They reduced the ſeven ſacraments of the Romaniſts to four, viz. baptiſm, the euchariſt, marriage, and ordination.

TACAMAHACA, in the materia medica, a reſin obtained from a tree reſembling the poplar, bearing at the extremities of the branches ſmall roundiſh fruits, including a ſeed like a peach-kernel; a native of the temperate parts of the continent of America, and in a ſheltered ſituation enduring the winters of our own country.

Two ſorts of this reſin are ſometimes to be met with. The beſt, called, from its being collected in a kind of gourd-ſhells, tacamahaca in ſhells, is ſomewhat unctuous and ſoft, of a pale yellowiſh or greeniſh colour, a bitteriſh aromatic taſte, and a fragrant delightful ſmell approaching to that of lavender and ambergris. This ſort is very rare. That commonly found in the ſhops is in ſemitranſparent grains, or glebes, of a whitiſh, yellowiſh, browniſh, or greeniſh colour, and of a leſs grateful ſmell than the foregoing. The firſt is ſaid to exude from the fruit of the tree, the other from inciſions made in the trunk. The tree, as raiſed among us, affords in its young buds, or the rudiments of the leaves, a reſinous juice of the ſame kind of fragrance.

Tacamahaca is uſed chiefly as an ingredient in warm nervine plaſters; though the fragrance and taſte of the finer ſort points out its being applicable to other purpoſes, as an internal balſamic corroborant. Both kinds diſſolve in rectified ſpirit into a gold-coloured liquor, only a ſmall quantity of impurities being left: they impregnate water alſo conſiderably with their ſmell and taſte, but give out very little of their ſubſtance to this menſtruum.

TACHYGRAPHY, *ταχυγραφια*, the art of writing faſt, or of ſhort-hand; of which authors have invented ſeveral methods.

TACTICS, in the art of war, is the method of diſpoſing forces to the beſt advantage in order of battle, and of performing the ſeveral military motions and evolutions.

TADPOLE, a young frog, before it has diſengaged itſelf from the membranes that envelope it in its firſt ſtage of life.

This animal furniſhes the curious in microſcopic obſervations with a beautiful view of the circulation of the blood, eſpecially when it is young.

The method of procuring them for this purpoſe in the greateſt perfection is this: let a ſmall quantity of frog's ſpawn be kept ſome days in water, and from this will be produced a vaſt number of young tadpoles; theſe, while very young, are perfectly tranſparent, and, when placed before the double microſcope, the heart may be eaſily ſeen, and its pulſation regularly obſerved; and the blood protruded thence may be beautifully ſeen circulating thro' the whole body; but particularly in the tail, where, tho' ſo very minute, more than fifty veſſels may be ſeen at one view. The young brood grow more and more opake every hour, and in a day or two the circulation of the blood can only be ſeen in their tail, or in the fins near the head.

TÆNIA, the TAPE-WORM, in zoology, a genus of worms, the body of which is of an oblong form, and compoſed of evident joints or articulations, in the manner of the links of a chain, or beads of a necklace.

The tape-worm grows frequently to ſeveral ells in length, and its articulations are a third of an inch long each. There is alſo another ſmall ſpecies, which never exceeds two inches in length, and is commonly not more than half an inch.

TÆNIA, in architecture, a member of the Doric capital, reſembling a ſquare fillet, or reglet: it ſerves inſtead of a cymatium.

TAFFETY, in commerce, a kind of fine, ſmooth, ſilken, ſtuff, having uſually a remarkable luſtre or gloſs.

There are taffeties of all colours, ſome plain, others ſtriped with gold, ſilver, ſilk, &c. others chequered, others flowered, others in the Chineſe point, others the Hungarian; with various others, to which the mode or the caprice of the workmen give ſuch whimſical names, that it would be as difficult as it is uſeleſs to rehearſe them; beſides that, they ſeldom hold beyond the year wherein they firſt roſe. The old names of taffeties, and which ſtill ſubſiſt, are taffeties of Lyons, Spain, England, Florence, Avignon, &c. The chief conſumption of taffeties is in ſummer-dreſſes for women, in linings, ſcarves, window-curtains, &c.

There are three things which contribute chiefly to the perfection of taffeties, viz. the ſilk, the water, and the fire. The ſilk is not only to be of the fineſt kind, but it muſt be worked a long time, and very much, before it be uſed. The watering, beſides that it is only to be given very lightly, ſeems only intended to give that fine luſtre, by a peculiar property not found in all waters. Laſtly, the fire, which is paſſed under it to dry the water, has its particular manner of application whereon the perfection of the ſtuff depends very much.

Octavio May, of Lyons, is held the firſt author of the manufacture of gloſſy taffeties; and tradition tells us the occaſion of it.—Octavio, it ſeems, going backwards in the world, and not able to retrieve himſelf by the manufacture of taffeties, ſuch as were then made, was one day muſing on his misfortunes, and, in muſing, chanced to chew a few hairs of ſilk which he had in his mouth. His reverie being over, the ſilk he ſpit out ſeemed to ſhine, and on that account engaged his attention. He was ſoon led to reflect on the reaſon; and, after a good deal of thought, concluded, that the luſtre of that ſilk muſt come, firſt, from his having preſſed it between his teeth. Secondly, from his having wet it with his ſaliva, which had ſomething glutinous in it; and thirdly, from its having been heated by the natural warmth of his mouth. All this he executed upon the next taffeties he made; and immediately acquired immenſe riches to himſelf, and to the city of Lyons the reputation it ſtill maintains, of giving the gloſs to taffeties, better than any other city in the world.

It will not, we conceive, be leſs uſeful than curious, to give here the deſcription of the engine contrived by Octavio to give the gloſs to taffety; to add the manner of applying it, and the compoſition of the water uſed therein.

The machine is much like a ſilk loom, except that, inſtead of iron points, here are uſed a kind of crooked needles, to prevent the taffety from ſlipping: at the two extremities, are two beams; on one of which is rolled the taffety, to take the gloſs; and on the other, the ſame taffety as faſt as it has received it. The firſt beam is kept firm by a weight of about 200 pounds; and the other turned by means of a little lever paſſing through mortiſes at each end. The more the taffety is ſtretched, the greater luſtre it takes; care, however, is to be uſed it be not over-ſtretched.

Beſides this inſtrument for keeping the ſtuff ſtretched, there is another to give it the fire: this is a kind of carriage, in form of a long ſquare, and the breadth of the taffeties. It moves on trundles, and carries a charcoal fire under the taffety, at the diſtance of about half a foot.

The two machines prepared, and the taffety mounted, the luſtre is given it by rubbing it gently with a ball, or handful of liſts of fine cloth, as it rolls from one beam to the other; the fire, at the ſame time, being carried underneath it to dry it. As ſoon as the piece has its luſtre, it is put on new beams to be ſtretched, a day or two; and the oftener this laſt preparation is repeated, the more it increaſes the gloſs.

For black taffeties, the gloſs is given with double beer, and orange or lemon juice; but this laſt is the leaſt proper, as being apt to whiten. The proportion of the two liquors is a gallon of orange juice to be boiled together to the conſiſtence of a rich broth. For coloured taffeties they uſe gourd-water, diſtilled in an alembic.

TAGETES, *French* MARYGOLD, or *African* MARYGOLD, in botany, the name of a genus of plants, the flower of which is of the radiated kind; its diſk is compoſed of floſcules divided into ſeveral ſegments, and its outer edge of ſemi-floſcules; all ſtanding on embryo ſeeds, and contained in a one-leaved cup of a tabulated form. The embryo's finally become ſeeds of an angular form, furniſhed with a foliaceous head, and affixed to the thalamus of the flower. There are alſo ſome ſpecies in which the flower is wholly compoſed of ſemi-floſcules.

We have a great many ſpecies of this plant annually raiſed in our gardens, for the beauty of their flowers. They are propagated by ſowing the ſeeds in ſpring, on a moderately hot-bed; when the young plants come up, they muſt have air allowed them; and, when three inches high, they ſhould be removed to another hot-bed, which ſhould be arched over with hoops that it may be ſheltered with mats. They are to be planted here at about eight inches diſtance, and, when they are grown ſtronger, as about the beginning of May, they are to be taken up with a ball of earth about their roots, and placed where they are to remain; or elſe at eighteen inches diſtance in a nurſery, where, when they flower, the fineſt ſorts may be marked and removed, with a large ball of earth to their roots, either into pots, or into the borders of the flower-garden. They are very beautiful; but their ſmell is very offenſive. *Miller's Gard. Dict.*

TAJACU, the MUSK-HOG, in zoology, a ſpecies of hog, with a cyſt on the back, and no tail: it is a native of Mexico, and is ſmaller than the common hog. On the middle of the head there ariſes a kind of creſt, compoſed of a large cluſter of briſtles; and on the middle of the back there is a kind of cyſt or gland, with an opening at the upper part, in which is ſecreted a perfumed fluid matter, of a mixt ſmell between that of muſk and civet; whence the Engliſh name.

TAIL, *Cauda*, the train of a beaſt, bird, or fiſh; which, in land animals, ſerves to drive away flies, &c. and in birds and fiſhes, to direct their courſe, and aſſiſt them in aſcending or deſcending in the air or water.

TAIL *of a Comet*, denotes the luminous rays iſſuing from a comet towards that part of the heavens from whence it ſeems to move. See COMET.

We have an enquiry into the cauſe of the tails of comets by Mr. Euler in the *Mem. de l'Acad. de Berlin*. He thinks there is a great affinity between theſe tails, the zodiacal light, and the aurora borealis; and that the common cauſe of them all is the action of the ſun's light on the atmoſpheres of the comets, of the ſun, and of the earth. He ſuppoſes that the impulſe of the rays of light on the atmoſphere of comets may drive ſome of the finer particles of that atmoſphere far beyond its limits; and that this force of impulſe, combined with that of gravity towards the comet, would produce a tail, which would otherwiſe always be in oppoſition to the ſun, if the comet did not move. But the motion of the comet in its orbit, and about an axis, muſt vary the poſition and figure of the tail, giving it a curvature, and deviation from a line drawn from the center of the ſun to that of the comet; and that this deviation will be greater, as the orbit of the comet has the greater curvature, and the motion of the comet is more rapid. It may even happen, that the velocity of the comet, in its perihelion, may be ſo great, that the force of the ſun's rays may produce a new tail before the old one can follow; in which caſe the comet might have two or more tails. The poſſibility of this is confirmed by the comet of 1744, which was obſerved to have ſeveral tails, while it was in its perihelion.

TAIL *of the Trenches*, in the art of war, is the poſt or place where the beſiegers begin to break ground.

Dragon's TAIL, in aſtronomy, the deſcending node of a planet.

Horſe's TAIL, in the cuſtoms of the eaſtern nations, is the enſign, or flag, under which they make war.

TAIL, or FEE-TAIL, in law, is a limited eſtate, or fee; oppoſed to fee-ſimple.

Fee tail is an inheritance whereof a perſon is ſeiſed, to him and the heirs of his body, begotten or to be begotten; ſo that the tenant in tail cannot alien, either before or after iſſue had, or forfeit ſuch lands, longer than for his own life: becauſe an eſtate in tail always remains

mains to the iſſue of the donee and his heirs; or in caſe he has no iſſue, then to the donor and his heirs.

Eſtates-tail of lands are either general or ſpecial. General tail is where lands or tenements are given to a man, or woman, and the heirs of either of their bodies begotten; which is called a general tail, becauſe however many wives a perſon that holds by this title ſhall have one after another in lawful marriage, his iſſue by them ſeverally are all ca pable of inheriting in their turns: and if the woman has iſſue by ſeveral huſbands, they may all inherit after each other, as heirs of her body. A tail-ſpecial, on the other hand, is when lands, &c. are limited to a man and his wife, and the heirs of their two bodies begotten, ſo that the children by a ſecond wife, or former wife, ſtand abſolutely excluded.

Where lands are granted to a man and his heirs-male, or heirs female of his body begotten, ſuch male or female iſſue ſhall only inherit purſuant to the limitation: and hence it is, that where a grant is to a man and the heirs-male of his body begotten, and he has iſſue a daughter, who has a ſon, this ſon cannot inherit the eſtate, becauſe he cannot prove his deſcent by heirs-male.

Where lands, &c. are given to a huſband and wife, and the heirs of their two bodies begotten in ſpecial tail, and one of them dies without iſſue had between them; in ſuch caſe, the ſurvivor ſhall hold the lands for life, as tenant in tail after poſſibility of iſſue extinct, as the lawyers call it.

Nevertheleſs, as great miſchiefs were occaſioned by inheritances being intailed; as defrauding of creditors, &c. diſobedience of ſons, when they knew they could not be diſinherited, and the like, the judges found out a way to bar an intailed eſtate with remainders over, by a feigned recovery.

TALC, or TALK, in natural hiſtory, a large claſs of foſſil bodies, compoſed of broad, flat, and ſmooth laminæ or plates, laid evenly and regularly on one another; eaſily fiſſile, according to the ſite of theſe plates, but not all ſo in any other direction; flexile and elaſtic; bright, ſhining and tranſparent; not giving fire with ſteel, nor fermenting with acid menſtrua, and ſuſtaining the force of a violent fire without calcining.

Venice talc is a ſoft ſmooth concrete, unctuous or ſopy to the touch, of a white or pale greeniſh colour, with a ſilver-like luſtre, generally found in ſmall pieces. It may be ſplit into numerous fine plates or leaves, which, ſingly, prove ſomewhat flexible and elaſtic, and perfectly pellucid, though the entire maſs is commonly opake, or at moſt only ſemitranſparent. The ſmalleſt pieces are to be preferred; the larger, however white and apparently pure on the outſide, being apt to have ſpecks or veins of heterogeneous matter in the internal part. This mineral has received the epithet Venetian, not from its being originally the product of Venice, but probably from that city having formerly been a principal mart for it. Though it may perhaps be met with in ſome parts of the Venetian dominions, it is more common in other countries; in Muſcovy, England, Norway, Hungary, Bohemia, Spain, and the Eaſtern nations.

Talc is generally ſuppoſed to be entirely unſubduable by fire. But Mr. Boyle relates, that having kept ſome Venice talc for a length of time in a glaſs-houſe furnace, it loſt of its volume, its compactneſs, and its luſtre, and became more brittle, though it ſtill retained the appearance which it had at firſt. I have myſelf alſo obſerved a like effect, the talc by ſtrong calcination having loſt its luſtre and unctuoſity, though the diminution in weight was only one dram upon ſix ounces: ſome white vapours aroſe in the calcination, reſembling thoſe of the acid of ſea-ſalt, but no ſpirit could be collected on repeating the operation in a retort; the talc here loſt nothing of its weight, but had contracted a blackiſh hue. Morhoff in his epiſtle to Langelott on the tranſmutation of metals, declares that he has ſeen talc, in the ſpace of half an hour and by a ſmall fire, calcined into a ſpongy maſs, friable betwixt the fingers into a ſubtile powder. Charas has already queſtioned this experiment, and we may be certain it was not performed on any true talc; probably the lapis ſpecularis, or ſelenites, were miſtaken for talc; a ſuſpicion which is countenanced by the author's own words; he ſays the mineral was deprived of its yellow colour, a colour which thoſe ſtones frequently have, but Venice talc has not. Though talc, however, in great meaſure reſiſts the action of culinary fire, I have found it incapable of reſiſting the concentrated ſolar heat: a piece of the true Venice talc, expoſed to the focus of Tſchirnhaus's large burning lens, preſently melted into an untranſparent vitreous maſs.

I have examined talc with all the mineral acids, and with alcaline lixivia, which ſome report to have a greater action on it; but without finding that either of them had any action at all; the talc remaining undiminiſhed in weight, and neither the talc or the liquors ſuffering any ſenſible alteration. I have calcined it alſo with ſulphur, with ſulphur and common ſalt, with nitre, with ſal ammoniac; without any other effect than a little change in its colour. On trying to melt it with twice its weight of borax the talc fell to the bottom, as ſoon as the borax came into fuſion. Alcaline ſalts, and cauſtic alcalies taken in four times the weight of the talc, ſucceeded no better; this refractory earth refuſing to unite with them: the ſalts being afterwards deliquiated in the air, the addition of acids occaſioned no precipitation, which they muſt have if the alcalies had taken up in fuſion any part of the talc.

Talc is employed, in thoſe places where it is found in any conſiderable quantity, in compoſitions for earthen veſſels; and by ſome for teſts and cupels. From its ſmoothneſs, unctuoſity, and brightneſs, it has been greatly celebrated as a coſmetic; and the chemiſts have ſubmitted it to a variety of operations, for procuring from it oils, ſalts, tinctures, magiſteries, &c. for that intention. But all their labours have been in vain; and all their preparations ſold under the name of talc have either contained nothing of that mineral, or only a fine powder of it.

The pulverization of this mineral is attended with ſome difficulty. The more brittle pieces may be pulverized pretty eaſily; but the very tough and flexible ſcarce at all; nor is the heating the mortar and peſtle red-hot, which ſome recommend, of any advantage. The moſt commodious method of reducing it into fine powder, is by cautiouſly filing, or grating it with a fiſh ſkin.

Beſides the white and greeniſh talcs already mentioned, there are yellow, red, and black ſoliaceous concretes diſtinguiſhed by the ſame name; but theſe are in general rather of the gypſeous than talky kind. Thus the black talc, mentioned by Hoffman, which laid on burning coals falls into leaves and acquires a golden colour, ſeems to be a ſpecies of lapis ſpecularis. Thoſe of a yellow colour have been called ſolar talcs, and imagined to be impregnated with a ſulphur of gold; which ſome of the chemiſts have pretended to extract by ſpirit of ſalt or aqua regis. But the yellow tincture which theſe minerals communicate, and the red ſublimate which ariſes on diſtilling the ſolutions, proceeds entirely from ferrugineous matter, common to theſe with other coloured earths. *Neumann's Chemiſtry.*

TALENT, *Talentum*, a weight and coin, both very famous among the ancients, but very different in different countries. The value of the talent is very hard to aſſign in Engliſh money, as being uſed among all the people throughout the Eaſt; and its value, and the manner of computation, different among each: A difficulty abundantly ſhewn by Budæus, in his learned treatiſe *De Aſſe*.

There were various kinds of talents, both with regard to weight and to ſpecies; the value of theſe laſt ſtill increaſing, as the metal of which it conſiſted was purer: though the talent weights all contained the ſame number of pounds and drams. For as the French have a livre Pariſis and a livre Tournois, each of which contains alike 20 ſols; yet, theſe compared together, the Paris livre contains 25 ſols of the Tournois livre, the Paris ſol exceeding that of Tours by one-fifth; ſo all talent weights were equally 60 minæ, and the mina 100 drachmæ; but the drachma of one place exceeding that of another, there hence aroſe a difference in the talents.

The Attic drachma, for inſtance, was 60 Attic oboli, and that of Ægina 10 of the ſame oboli, whence the

Æginean

Æginean talent, computed on the foot of the Attic weight, was 100 minæ; whereas, reckoned on the foot of its own drachma, it was no more than 60.

The common Attic talent then, the talent weight we mean, contained 60 Attic minæ, or 62 and a half Attic pounds, or 6000 Attic drachmæ; equal, according to Dr. Arbuthnot's reduction, to 56 pounds 11 ounces Engliſh troy-weight. Some authors, as Priſcian, mention another Attic talent of 100 minæ; but this is to be underſtood of ancient minæ, as they ſtood before Solon, each only worth 75 drachmæ.

The Syrian talent contained 15 Attic minæ; that of Alexandria 96 Attic minæ, or 91 ℔. troy. The Babylonic, Perſian, and Antiochic talents were the ſame with the Egyptian. Among the Romans there were two kinds of talents, the little and the great talent: the little was the common talent; and whenever they ſay, ſimply, *talentum*, they are to be underſtood of this: the little talent was 60 minæ, or Roman pounds; the mina, or pound, eſtimated at 100 drachmæ, or denarii: it was alſo eſtimated at 24 great ſeſterces, which amounted to 60 pounds.

The great talent exceeded the leſs by one-third part. Budæus computes, that the little talent of ſilver was worth 75 pounds ſterling; and the greater 99 l. 6 s. 8 d. ſterling — The greater talent of ſilver he makes worth 99 l. ſterling. —The greater of gold worth 1125 l. ſterling.

TALENT, as a ſpecies, or money, among the Hebrews, was ſometimes uſed for a gold coin, the ſame with the ſhekel of gold, called alſo ſtater, and weighing only four drams. The Hebrews reckoned by theſe talents as we do pounds, &c. Thus a million of gold, or million of talents of gold, among them, was a million of ſhekels, or nummi; the nummus of gold being the ſame weight with the ſhekel, viz. 4 drams.

Yet the Hebrew talent weight of ſilver, which they called cicar, was equivalent to that of 3000 ſhekels, or 113 pounds Engliſh troy-weight, according to Arbuthnot's computation.

TALES, in law, a word uſed for a ſupply of men impannelled on a jury, and not appearing; or upon appearance, being challenged for the plaintiff or defendant, as not indifferent; in which caſe the judge, upon motion, of courſe grants a ſupply to be made by the ſheriff, of ſome perſons there preſent, equal in reputation to thoſe that are impannelled. Where a perſon has had one tales, he may have another, but not have the latter to contain ſo many as the former, becauſe the firſt tales muſt be under the number of the principal pannel, except in the caſe of appeal; and in like manner every tales is to be leſs than other, until the whole number made uſe of, are perſons without exception. There are two kinds of tales, the one de circumſtantibus, and the other a decem tales: that of circumſtantibus, is, when a full jury does not appear at the niſi prius, or ſo many are challenged as not to have a full jury; on which motion being made, the judge will grant this tales, which the ſheriff immediately returns into court. A decem tales is when a full jury does not appear at a trial at bar, in which caſe this writ goes out to the ſheriff, commanding him to *apponere decem tales*.

TALIO, *Lex Talionis*, a ſpecies of puniſhment in the Moſaic law, whereby an evil is returned ſimilar to that committed againſt us by another; hence that expreſſion, "Eye for eye, tooth for tooth." This law was at firſt inſerted in the twelve tables amongſt the Romans, but afterwards ſet aſide, and a power given to the prætor to fix upon a ſum of money for the damage done.

TALISMANS, magical figures cut or engraved with ſuperſtitious obſervations on the characteriſms and configurations of the heavens, to which ſome aſtrologers have attributed wonderful virtues, particularly that of calling down celeſtial influences.

The word is pure Arabic; though Menage, after Salmaſius, thinks it may come from the Greek, τελεσμα, operation, or conſecration. Borel ſays it is Perſian, and ſignifies literally, an engraven conſtellation. Others derive it *à talamacis literis*, which are myſterious characters, or cyphers uſed by ſocerers; thus called from *talamaſca*, a phantom, or illuſion.

TALLOW, a ſort of animal fat melted down and clarified for the uſe of making candles, &c. See the article CANDLE.

TALLOW-TREE, in China, is a tree growing in great plenty in that country, which produces a ſubſtance like our tallow, and ſerving for the ſame purpoſe.

It is about the height of a cherry-tree, its leaves in form of a heart, of a deep-ſhining red colour, and its bark very ſmooth. Its fruit is incloſed in a kind of pod, or cover like a cheſnut, and conſiſts of three round white grains of the ſize and form of a ſmall nut, each having its peculiar capſula, and within a little ſtone. This ſtone is encompaſſed by a white pulp, which has all the properties of true tallow, both as to conſiſtence, colour, and even ſmell; and accordingly the Chineſe make their candles of it; which would doubtleſs be as good as thoſe in Europe, if they knew how to purify their vegetable, as well as we do our animal, tallow.

All the preparation they give it, is to melt it down and mix a little oil with it, to make it ſofter and more pliant. It is true their candles made of it yield a thicker ſmoke, and a dimmer light, than ours; but thoſe defects are owing in a great meaſure to the wicks, which are not of cotton, but only a little rod of dry light wood covered with the pith of a ruſh wound round it; which, being very porous, ſerves to filtrate the minute parts of the tallow, attracted by the burning ſtick, which by this means is kept alive.

TALLY, in law, a piece of wood cut in two parts, whereon accounts were antiently kept, by means of notches; one part of the tally being kept by the debtor, and the other by the creditor.

As to the tallies of loans, one part thereof is kept in the Exchequer, and the other part given to particular perſons in lieu of an obligation for the monies they have lent to the government on acts of parliament. This laſt part is called the ſtock, and the former the counter ſtock, or counter tail.

Tallies of debt, are a kind of acquittance for debt paid to the king, upon the payment of which every debtor receives one of theſe tallies; and on carrying the ſame to the clerk of the Pipe-office, has an acquittance there given him, on parchment, for his full diſcharge.

Tallies of reward, were an allowance made to ſheriffs for ſuch ſums as they have caſt upon them in their accounts, but cannot levy.

TALMUD, or THALMUD, among the Jews, a collection of the doctrines of their religion and morality. It is the *corpus juris*, or body of the laws and cuſtoms of the Jews, who eſteem it equal to the ſcriptures themſelves.

TALON, in architecture, a kind of moulding, which conſiſts of a cymatium, crowned with a ſquare fillet; frequently found to terminate joiners-work, as thoſe of doors, windows, &c.

TALPA, in ſurgery, is a tumour generally confined to the head, and appearing as the conſequence of the venereal diſeaſe. The talpæ elevate the ſkin from the pericranium, and generally denote a foulneſs of the bone beneath; but the nates are generally ſeated in the neck.

TALUS, in anatomy, the ſame with the aſtragal. See ASTRAGAL.

TALUS, or TALUT, in architecture, the inclination or ſlope of a work; as of the outſide of a wall, when its thickneſs is diminiſhed by degrees, as it riſes in height to make it the firmer.

TALUS, in fortification. Talus of a baſtion, or rampart, is the ſlope or diminution allowed to ſuch a work, whether it be of earth or ſtone, the better to ſupport its weight.

The exterior talus of a work, is its ſlope on the ſide towards the country; which is always made as little as poſſible, to prevent the enemy's ſcalado; unleſs the earth be bad, and then it is abſolutely neceſſary to allow a conſiderable talus for its parapet. The interior talus of a work is its ſlope on the inſide towards the place.

TAMARIND, *Tamarindus*, in the materia medica, the fruit of a pretty large tree, growing in Arabia, and in the Eaſt and Weſt Indies. The fruit is a pod, ſomewhat reſembling a bean cod, including ſeveral hard ſeeds,

together with a dark-coloured viſcid pulp: the Eaſt India tamarinds are longer than thoſe of the Weſt, the former containing ſix or ſeven ſeeds each, the latter rarely above three or four: they nevertheleſs ſeem both to be the produce of one ſpecies of plant. The pulp, with the ſeeds, connected together by numerous tough ſtrings or fibres, are brought to us freed from the outer ſhell: the oriental ſort is drier and darker-coloured than the occidental, and has more pulp: the former is ſometimes preſerved without addition, the latter has always an admixture of ſugar.

The pulp of tamarinds is an agreeable laxative acid; of common uſe in inflammatory and putrid diſorders, for abating thirſt and heat, correcting putrefaction, and looſening the belly. The doſe, as a laxative, is two or three drams: an ounce or two prove moderately cathartic. It is an uſeful addition to the purgative ſweets, caſſia and manna, increaſing their action, and rendering them leſs liable to produce flatulencies: the reſinous cathartics are ſomewhat weakened by it. Tournefort obſerves that an eſſential ſalt may be obtained from tamarinds, by diſſolving the pulp in water, and ſetting the filtered ſolution, with ſome oil upon the ſurface, in a cellar for ſeveral months; that the ſalt is of a ſouriſh taſte, and difficultly diſſoluble in water; and that a like ſalt is ſometimes found alſo naturally concreted on the branches of the tree.

The tamarind tree grows to a very large ſize in thoſe countries where it is a native, but in England it will not thrive out of a ſtove, eſpecially in winter. The ſtem is very large, covered with a brown bark, and divides into many branches at the top, which ſpread wide every way, and are cloſely garniſhed with winged leaves, compoſed of ſixteen or eighteen pair of lobes, without a ſingle one at the end. The lobes are about half an inch long, and a ſixth part of an inch broad, of a light green, a little hairy, and ſit cloſe to the midrib. The flowers come out from the ſide of the branches five, ſix, or more together upon the ſame foot ſtalk in looſe branches; theſe are compoſed of five reddiſh petals, one of which is reflexed, upward like the ſtandard in ſome of the butterfly flowers, two others ſtand on each ſide like the wings, and the other two are turned downwards.

The plants are preſerved in the gardens of thoſe who have conveniency to maintain rare exotic trees and ſhrubs.

They are eaſily propagated by ſowing their ſeeds on a hot-bed in the ſpring; and when the plants are come up, they ſhould be planted each into a ſeparate ſmall pot, filled with light rich earth, and plunged into a hot-bed of tanners bark to bring them forward, obſerving to water and ſhade them until they have taken root; and as the earth in the pots appears dry, they muſt be watered from time to time, and ſhould have air given them in proportion to the warmth of the ſeaſon and the bed in which they are placed: when the pots in which they are planted, are filled with their roots, the plants ſhould be ſhifted into pots of a larger ſize, which muſt be filled up with rich light earth, and again plunged into the hot-bed, giving them air, as before, according to the warmth of the ſeaſon; but in very hot weather the glaſſes ſhould be ſhaded with mats in the heat of the day, otherwiſe the ſun will be too violent for them through the glaſſes, nor will the plants thrive, if they are expoſed to the open air, even in the warmeſt ſeaſon; ſo that they muſt be conſtantly kept in the bark ſtove both ſummer and winter, treating them in the ſame manner as the coffee-tree, with whoſe culture they will thrive exceeding well.

TAMBAC, a mixture of gold and copper, which the people of Siam hold more beautiful, and ſet a greater value on, than gold itſelf.

TAMBOUR, in architecture, a term applied to the Corinthian and Compoſite capitals, as bearing ſome reſemblance to a drum, which the French call tambour.

TAMBOUR is alſo uſed for a little box of timber-work covered with a ceiling, withinſide the porch of certain churches both to prevent the view of perſons paſſing by, and to keep off the wind, &c. by means of folding doors.

TAMBOUR alſo denotes a round coarſe ſtone, ſeveral of which form the ſhaft of a column not ſo high as a diameter.

TAMPION, or TOMPION, among gunners, a plug to ſtop the mouths of cannons, mortars, &c. to keep them clean within.

TAN, the bark of oak, chopped and ground by a tanning mill into a coarſe powder to be uſed in the tanning or dreſſing ſkins.

Tan is of great uſe in gardening: firſt, by its fermentation, when laid in a body, which is always moderate and of a long duration, which renders it of great ſervice to hot-beds: and, ſecondly, after it is well rotted, it becomes excellent manure for all ſorts of cold ſtiff land; upon which one load of tan is better than two of rotten dung, and will continue longer in the ground.

The uſe of tan for hot-beds has not been many years known in England; the firſt hot-beds of this ſort, which were made in England, were at Blackheath, in Kent, about fifty-five years ago: theſe were deſigned for raiſing of orange-trees; but, the uſe of theſe hot-beds being but little known at that time, they were made but by two or three perſons, who had learned the uſe of them in Holland and Flanders, where the gardeners ſeldom made any other hot-beds: but in England there were very few hot-beds made of tanner's bark, before the ananas were introduced into this country, which was in 1719, ſince which time the uſe of theſe hot-beds have been more general; and are now made in all thoſe gardens, where the ananas plants are cultivated, or where there are collections of tender exotic plants preſerved: and the gardeners here are now better ſkilled in making and managing of theſe hot-beds, than in moſt other countries; which might render it leſs neceſſary to give a full deſcription of them here: but, yet, as there may be ſome perſons in the remote parts of England, who have not had an opportunity of informing themſelves of the uſe of tanners bark for this purpoſe, I ſhall inſert the ſhorteſt and plaineſt method of making and managing theſe hot-beds, as they are practiſed by the moſt knowing perſons, who have long made uſe of theſe-hot beds: and, firſt, I ſhall begin with the choice of the tan.

The tanners in ſome parts of England do not grind the bark to reduce it into ſmall pieces, as is commonly practiſed by the tanners near London; where there is great difference in the ſize of the bark, ſome being ground much ſmaller than the other, according to the different purpoſes for which it is intended; but in many places the bark is only chopped into large pieces, which renders it very different for the uſe of hot-beds; for, if the tan is very coarſe, it will require a longer time to ferment, than the ſmall tan; but, when it begins to heat, it will require a much greater degree, and will retain the heat a much longer time than the ſmall; therefore, where there is choice, the middling-ſize tan ſhould be preferred; for it is very difficult to manage an hot-bed when made of the largeſt tan: the heat of which is often ſo great, as to ſcald the roots of plants, if the pots are fully plunged into the bed; and I have known this violent heat continue upwards of two months; ſo that it has been unſafe to plunge the pots more than half their depth into the tan, till near three months after the beds have been made: therefore, where the perſons, who have the care of theſe beds, do not diligently obſerve their working, they may in a ſhort time deſtroy the plants which are placed in the beds: on the other hand, if the tan is very ſmall, it will not retain the heat above a month, or five weeks; and will be rotten and unfit for an hot-bed in a ſhort time; ſo that, where the middle-ſized tan can be procured, it ſhould always be preferred to any other.

The tan ſhould be always ſuch as has been newly taken out of the pits; for if it lies long in the tanner's yard, before it is uſed, the beds ſeldom acquire a proper degree of heat; nor do they continue their heat long; ſo that when it has been more than a fortnight or three weeks out of the pit, it is not ſo good for uſe as that which is new. If the tan is very wet it will be proper to ſpread it abroad for two or three days to drain out the moiſture, eſpecially if it is in the autumn or winter ſeaſon; becauſe, then, as there will be little ſun to draw a warmth into the tan, the moiſture will prevent the fer-

mentation, and the beds will remain cold: but, in the ſummer-ſeaſon, there is no great danger from the moiſture of the tan; the heat of the ſun through the glaſſes will be then ſo great, as ſoon to cauſe a fermentation in the tan.

Theſe tan-beds ſhould always be made in pits, having brick walls round them, and a brick pavement at the bottom, to prevent the earth from mixing with the tan; which will prevent the tan from heating; theſe pits muſt not be leſs than three feet deep, and ſix feet in width; the length muſt be in proportion to the number of plants they are to contain: but, if they are not ten feet in length, they will not retain their heat long: for, where there is not a good body of tan, the out-ſide of the bed will ſoon loſe its heat; ſo that the plants which are there plunged, will have no benefit of the heat; nor will the middle of theſe beds retain their heat long; ſo that they will not anſwer the purpoſe for which they are intended.

When the tan is put into the bed, it muſt not be beaten or trodden down too cloſe; for that will cauſe it to adhere, and form one ſolid lump; ſo that it will not acquire an heat; nor ſhould it be trodden down at the time when the pots are plunged into the beds; to avoid which there ſhould be a board laid croſs the bed, which ſhould be ſupported at each end to prevent its reſting on the tan; upon which the perſon ſhould ſtand, who plunges the pots; ſo that the tan will not be preſſed down too cloſe. When the tan is quite freſh, and has not been out of the pits long enough to acquire an heat, then the beds will require a fortnight or three weeks time, or ſometimes a month, before they will be of a proper temperature of warmth to receive the plants: but, in order to judge of this, there ſhould be three or four ſticks thruſt down into the tan, about eighteen inches deep, in different parts of the bed; ſo that by drawing out the ſticks, and feeling them at different depths, it will be eaſy to judge of the temper of the beds; and it will be proper to let a few of theſe ſticks remain in the bed, after the plants are plunged, in order to know the warmth of the tan; which may be better judged of by feeling theſe ſticks, than by drawing out the pots, or plunging the hand in the tan.

When the tan is good, one of theſe beds will retain a proper degree of heat for near three months; and, when the heat declines, if the tan is forked up, and turned over, and ſome new tan added to it, the heat will renew again, and will continue two months longer: ſo that by turning over the tan, and adding ſome new tan every two months, or thereabout, as the bed is found to decline of its heat, they may be continued one year: but every autumn it will be proper to take out a good quantity of the old tan, and to add as much new to the bed, that the heat of the bed may be kept up in winter; for, if the heat is ſuffered to decline too much during the cold ſeaſon, the plants will ſuffer greatly: to prevent this, there ſhould always be ſome new tan added to the bed in winter, when the heat is found to decline; but the tan ſhould be laid in a dry place, a week or ten days, to dry, before it is put into the bed; otherwiſe the moiſture will chill the old tan in the bed, and prevent the fermentation: ſo that unleſs the tan is turned over again, there will be little or no heat in the beds: which often proves fatal to the plants which are plunged into them: therefore, whoever has the management of theſe beds, ſhould be very careful to obſerve conſtantly the warmth of the tan; ſince, upon keeping the beds in a due temperature of warmth, the whole ſucceſs depends; and, where this caution is not taken, it frequently happens, that the ananas plants run into fruit very ſmall, or the plants are infeſted by inſects; both which are occaſioned by the growth of the plants being ſtopped by the decline of the heat of the tan; therefore great regard muſt be had to that, eſpecially in winter.

The great advantages which theſe tan-beds have of thoſe which are made of horſe-dung, are, the moderate heat which they acquire; for their heat is never ſo violent as thoſe of horſe-dung; and they continue this heat much longer; and, when the heat declines, it may be renewed, by turning the beds over, and mixing ſome new tan with the old, which cannot be ſo well done with horſe-dung; and likewiſe the beds will not produce ſo great ſteams, which are often injurious to tender plants; ſo that theſe tan-beds are much preferable to thoſe of horſe-dung for moſt purpoſes.

Tan, when it is well rotted, is alſo an excellent manure for all cold and ſtiff lands: and if it is laid upon graſs-ground in autumn, that the rains in winter may waſh it into the ground, it will greatly improve the graſs; but when it is uſed new, or in the ſpring of the year, when dry weather comes, it is apt to cauſe the graſs to burn; which has occaſioned the diſuſe of tan in many places; but, if properly uſed, it will be found an excellent dreſſing for all ſtiff lands.

Flowers of TAN.—Flower of tan is a name given by the people employed in the tanning trade to a yellow ſubſtance, often found upon old tan, or oak bark broken to pieces, which has been uſed as tan, and is of no farther ſervice.

The name, however, is very improper; and, though every body converſant in tan-yards muſt have ſeen the thing, yet it has always paſſed as an efflorеſcence of the bark, till the curious Mr. Marchand enquired more accurately into its nature, and found it to be a plant of itſelf, wholly different from the matter of the tan; and to which the bark which had been often wetted and dried again, ſerved as a proper matrix. He found it to be more nearly allied to the ſponge than to any other genus of plants; and therefore named it "Spongia fugax, mollis, flava, et amœna in pulvere coriario naſcens, ſoft, beautiful, yellow, fading ſpunge, growing on tanners bark."

It makes its appearance moſt frequently in the ſummer months, and is then ſeen in ſmall tufts of a beautiful yellow colour, on different parts of the old heaps of bark. It appears at firſt in form of a thin yellow ſcum, and is of a ſort of jelly-like ſtructure; but it every day grows larger and thicker, till it ſtands above half an inch out from the ſurface of the bark. As it grows, its ſurface becomes more and more cavernous and ſpungy, the pores or holes being of different diameters, and the interſticial matter forming a ſort of net-work more or leſs regular, and often interrupted by irregular prominences in ſeveral parts; and, in fine, when the growth is complete, the whole more reſembles a ſpunge, than any other vegetable ſubſtance, and is of a deep yellow colour, and conſiderably thick and tough conſiſtence; there are no roots to be diſcovered iſſuing from it; its ſmell is like to that of rotten wood, and its taſte is ſomewhat ſtyptic. It always appears in the warm months, and always upon ſuch old tan as has begun to ferment, and is in the ſtate in which our gardeners uſe it for hot-beds. If it happens to ſtand expoſed to the ſouth ſun, it is but of ſhort duration; but, if it be in a ſheltered place, it will laſt a conſiderable time, and often ſpread itſelf to a great extent, and make a very beautiful figure for many weeks. *Mem. Acad. Par.* 1727.

TANGENT, in geometry, a right-line which touches a circle but in one point, and conſequently, if infinitely produced, could never cut the ſame.

TANGENT *of an Arch*, is a right-line drawn perpendicularly from the end of a diameter, paſſing to one extremity of the arch, and terminated by a right-line drawn from the center, through the other extremity of the arch.—Thus A T, plate CXXV. *fig.* 3. is the tangent of the arches S A and S D.

Co-TANGENT *of an Arch*, is the tangent of the complement of that arch.—Thus B G is the co-tangent of the arch S A, or the tangent of the arch S B the complement of S A.

TANGENT *of a Curve*, is a right-line which only touches the curve in one point, but does not cut it.

Method of drawing TANGENTS *to Curves*.—The fluxion of the ordinate is to the fluxion of the abſciſſe, as the ordinate is to the ſub-tangent.

Let A C *c*, plate CXXV. *fig.* 4. repreſent a curve, A its vertex, A B the abſciſſe, B C the ordinate, V C a tangent to the curve in the point C, and V B the ſub-tangent. I ſay, that the ordinate B C is to the ſub-tangent V B, as the fluxion of the ordinate B C is to the fluxion of the abſciſſe A B.

Conceive the ordinate B C to flow uniformly, and move till it come into the place *b c*, and draw C E parallel to A B.

Primum Mobile.

Fig. 1.
Ptolemaic System.

Fig. 2.
Tychonic System.

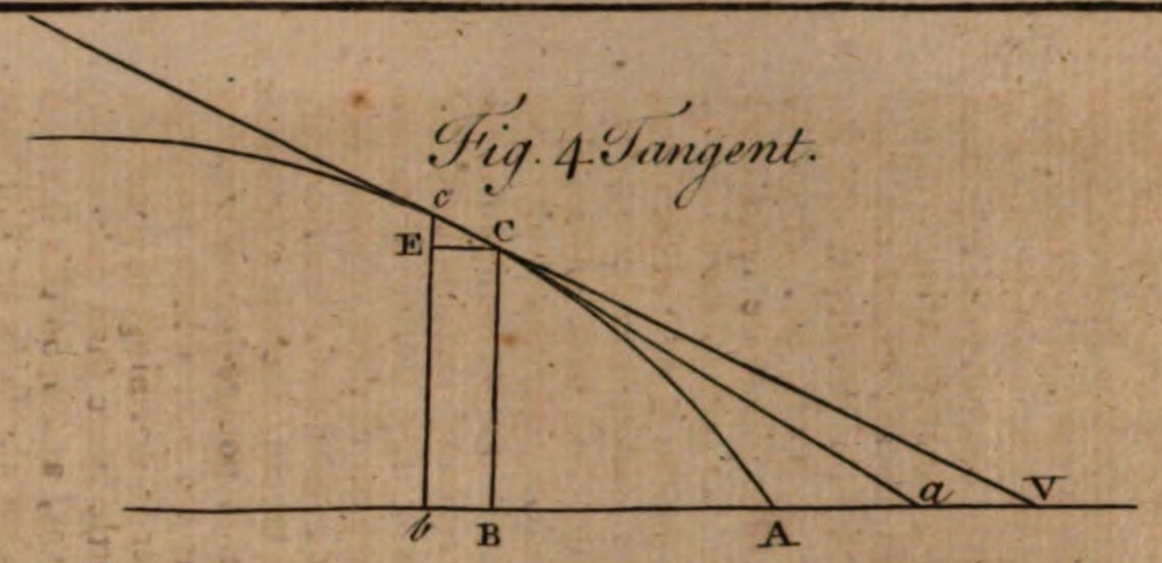


Fig. 4. Tangent.

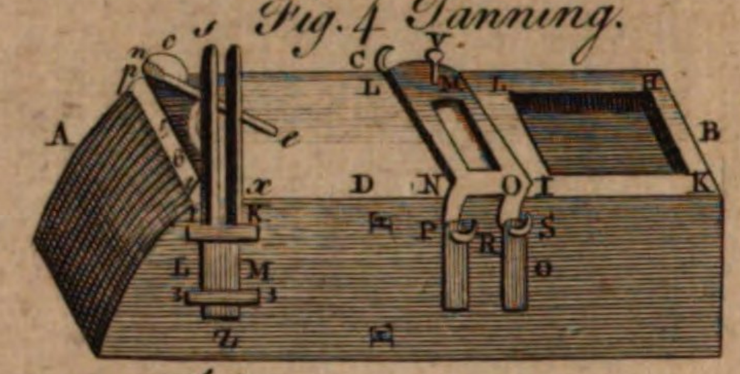


Fig. 4. Tanning.

Fig. 6.

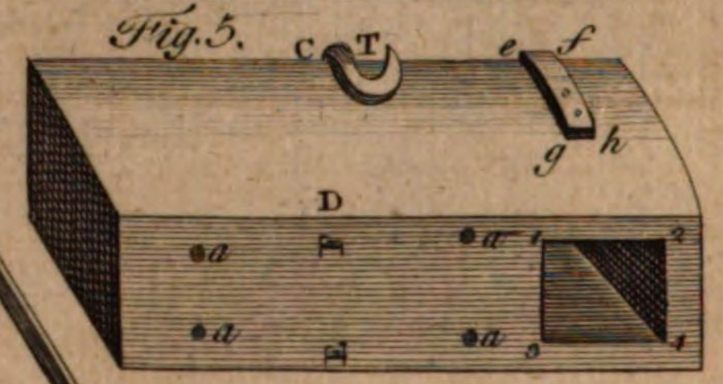


Fig. 5.

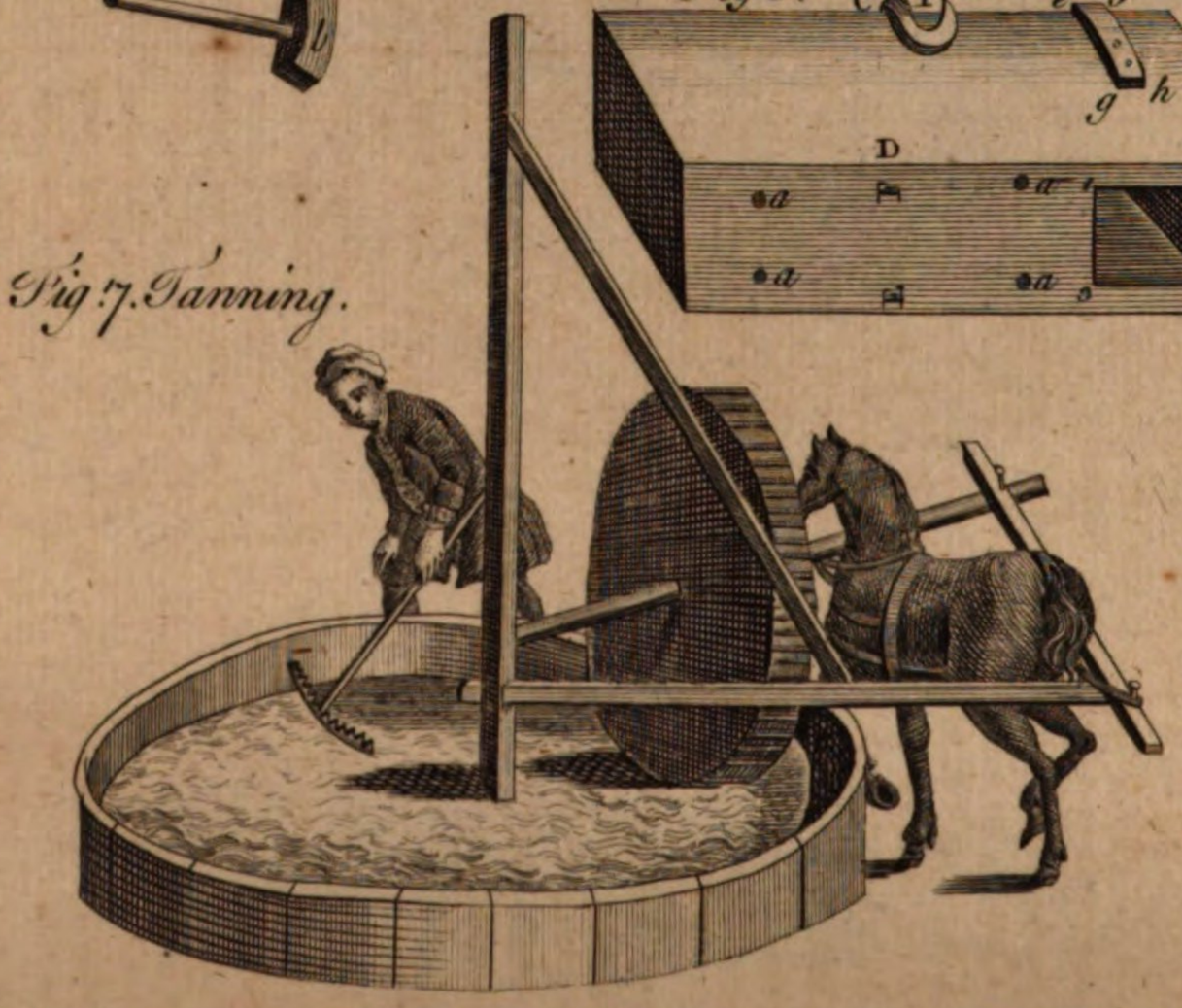


Fig. 7. Tanning.

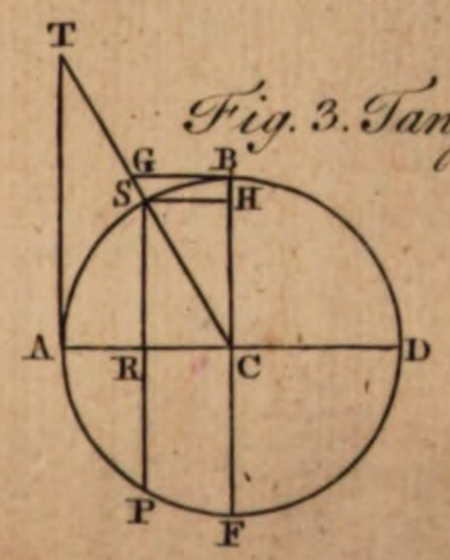


Fig. 3. Tangent.

Tantalus's Cup.

Fig. 10.

Fig. 9.

Fig. 8.

It is manifeſt that C E and *c* E are in the firſt ratio of the naſcent increments of A B and B C, generated in the firſt moment of time; for while A B flowed into, or became A *b*, B C flowed into or became *b c*.

Draw C *c* ſubtending the arch C *c*, and produce it till it cut the abſciſſe produced in the point *u*, then will the triangles E C *c* and *c b u* be ſimilar.

And it will be as $c\,E : E\,C :: c\,b : b\,v$;
That is, as $c\,E : E\,C :: c\,E + E\,b : b\,B + B\,u$;
For $c\,b = c\,E + E\,b$, and $b\,u = b\,B + B\,u$:
Alſo, $E\,b = C\,B$, and $B\,b = C\,E$;
Wherefore, $c\,E : E\,C :: c\,E + C\,B : E\,C + B\,u$.

Let us now imagine the ordinate *b c* to return back into its former place, and become B C, at which time the right lines *c* C *u* and V C will be coincident, the increments *c* E E C will vaniſh, and the triangle *c* E C, in its evaneſcent form, will be ſimilar to the triangle C B V, and conſequently, $c\,E : E\,C :: C\,B : B\,V$, which was the thing to be demonſtrated. Whence it follows, ſuppoſing x to repreſent the abſciſſe A B of any curve A C, y the ordinate B C, and t the ſub-tangent B V, that $\dot{y} : \dot{x} :: y : t$; whence $t\dot{y} = \dot{x}y$, and $t = \frac{\dot{x}y}{\dot{y}}$; and hence ariſes this general rule for drawing of tangents to curves.

1. Find the fluxionary value of the abſciſſe from the equation expreſſing the nature of the curve.

2. Multiply the fluxionary value by y, and divide that product by the fluxion of the ſame ordinate. Or, which is the ſame thing, in the room of $\dot{y}$, in the fluxionary value of the ſub-tangent, ſubſtitute the fluent itſelf, and the reſult, in either way, will be the value of the ſub-tangent in the terms of the equation firſt given. And hence we are taught how to draw a tangent to any point in a curve, the equation, expreſſing the nature of the curve, being firſt given.

Let it be required to draw a tangent to a given point in the curve of the common parabola. The equation of this curve being $2px = y^2$ ($2p$ being the latus rectum) we ſhall have $2p\dot{x} = 2y\dot{y}$, and conſequently $\dot{y} = \frac{2p\dot{x}}{y}$; whence $\frac{y\dot{x}}{\dot{y}}$, or its equal t, becomes $\frac{yy}{p}$, or $2x$: hence it appears that in the common parabola the ſubtangent is double the abſciſſa.

Line of TANGENTS, a line uſually placed on the ſector and Gunter's ſcale. See SECTOR, and GUNTER'S *Scale*.

TANNER, one who dreſſes hides, &c. by tanning them.

TANNING, the preparing of ſkins or hides in a pit, with tan and water, after the hair has been firſt taken off, by putting the ſkins into lime-water.

Method of TANNING *Oxen-hides*. The ſkin being flayed off the carcaſe, if it is intended to be kept, is ſalted with ſea-ſalt and alum, or with a coarſe kind of ſalt-petre. If it is not for keeping, the ſalting is ſaved, as being of no uſe but to prevent the hide from corrupting before it can be conveniently carried to the tan-houſe. Whether the hide has been ſalted or not, the tanner begins with taking off the horns, the ears, and the tail, after which it is thrown into a running water for about thirty hours, to waſh off the blood and other impurities adhering to the inſide. This done, it is laid over night in a lime-pit, already uſed, whence it is taken and left to drain three or four days on the edge of the pit. The firſt and ſlighteſt preparation over, it is retained into a ſtrong lime-pit for two days, then taken out for four days more; and thus for ſix weeks alternately it is taken out and put in twice a week. At the ſix weeks end it is put into a freſh pit, where it continues eight days, and is then taken out for ſo many, and thus alternately for a year or eighteen months, according to the ſtrength of the leather and the weather; for in great heats they put in freſh lime twice a week; and in froſt they ſometimes do not touch them for three months.

Every freſh lime-pit they throw them into, is ſtronger and ſtronger. At the end of four, five, or ſix weeks, the tanner ſcrapes off the hair on a wooden leg or horſe, with a kind of knife made for that purpoſe. And after a year or eighteen months, when the hair is perfectly gone, he carries it to a river to waſh, pares off the fleſh on the leg with a kind of cutting knife, and rubs it briſkly with a ſort of whetſtone, to take off any remains of fleſh or of filth on the ſide of the hair. The ſkin is now put into tan, that is, it is covered with tan as it is ſtretched in the pit, and water is let in upon it; if the ſkin is ſtrong, five coverings of tan will be required; for weaker, three or four may ſuffice. When the ſkin has not been kept long enough in lime, or in the tan-pit, upon cutting it in the middle there appears a whitiſh ſtreak, called the horn or crudity of the ſkin, and it is this crudity that is the reaſon why the ſoles of ſhoes, boots, &c. ſtretch ſo eaſily and take water. When the hides are ſufficiently tanned, they are taken out of the pit to be dried, by hanging them in the air; then the tan is cleared off them, and they are put into a place neither too dry nor too moiſt; they are there well ſtretched over one another with weights a-top, to keep them tight and ſtrait; and in this condition are ſold under the denomination of bend-leather. This is the method of tanning bullocks or oxen-hides. Cows, calves, and horſes ſkins are tanned much after the ſame manner of thoſe of oxen, except that they are only kept four months in the lime pit, and that before they be put in the tan, there is a preparation required thus: cold water is poured into a wooden vat, or tub, wherein the ſkins are put, which are kept ſtirring while ſome other water is warming in a kettle; and as ſoon as that water is little more than lukewarm, it is poured gently into the vat, and upon this is caſt a baſket of tan; during which time the ſkins are ſtill kept turning, that the water and tan may not ſcorch them. After an hour they are taken out and caſt for a day into cold water, then returned to the former vat and the ſame water they had been in before, and here they are left for eight days: which expired, they are put into the tan-pit, and three coverings of tan given them; the firſt of which laſts five weeks, the ſecond ſix, and the third two months.

The operation of tanning is performed, on leather, better in the Weſt Indies than in England. They uſe three ſorts of bark, the mangrove bark, the olive-bark, and another; and the whole buſineſs is ſo ſoon done, that a hide delivered to them is in ſix weeks ready to be worked into ſhoes, though they beſtow leſs labour than we do. *Phil. Tranſ.* N°. 36.

Every part of the oak-tree, of what age or growth ſoever, is fit for the tanners uſe, and all oaken coppice-wood, of any age or ſize, being cut and procured in barking-time, will tan all ſort of leather, at leaſt as well as the bark alone. When this material is got at the proper ſeaſon, it muſt be very well dried in the ſun more than the bark alone; thence it is to be cut up, and preſerved in a covered place for uſe.

When it is to be uſed, the greater wood muſt be firſt cleft ſmall, to fit it for the beating and cutting engine; and the ſmaller muſt be put into the engine as it is. Which done, it muſt be again dried on a kiln, and after that ground in the ſame manner that the tanners grind their bark. Such wood as is to be uſed preſently after it is gotten, will require the better and the more drying upon the kiln; and, if this is omitted, it will blacken and ſpoil all the leather it is to be uſed about. Where oak is ſcarce, black-thorn will tolerably well ſupply its place, and, where that is not to be had in ſufficient plenty, the white-thorn will do. *Phil. Tranſ.* N°. 108.

Birch alſo, being ordered in the ſame manner with oak, is fit for ſome uſes in tanning, particularly it does very well for tanning of ſhoe-ſole leather. All theſe ingredients will tan much better than bark alone, and that with much leſs charge; ſo that this diſcovery may very well ſave the felling of trees when the bark is wanted, at a ſeaſon when the ſap is up, which, when it is done, cauſes the outſides of the trees to rot and grow worm-eaten; whereas, if the trees had been felled in winter, when the ſap is down, they would have been almoſt all heart, as the people expreſs it, and not ſubject to worms. The manner of uſing the wood with the bark, in tanning, will alſo increaſe the value of underwoods very conſiderably. *Phil. Tranſ.* N°. 105.

The engine neceſſary for cutting the wood conſiſts of a long ſquare wooden block, and ſome pieces of iron to be

be faſtened on, and uſed about it, viz. a hammer, an anvil, and iron holding the wood to be bruiſed and cut, and a knife to cut it. The whole is a very ſimple and cheap machine, and is deſcribed at large, and figured in the abovementioned number in the *Philoſophical Tranſactions*.

By Mr. de Buffon's experiments upon different ſkins, it was found that a decoction of young oak wood ſucceeded perfectly well in tanning ſheep and calves ſkins, but did not do equally well for ox, and the other harder ſkins. This, however, he imagines might be only for want of knowing the beſt method of uſing the wood. And, certainly, theſe trials deſerve to be farther proſecuted; ſince the ſmall branches of the oak, which are of little value, might be thus made to ſupply the place of a much dearer commodity, the bark; and, as in many trees, the bark of the young branches is found to be of greatly more virtue than that of the larger branches, or the trunk, the uſe of theſe ſmall boughs, bark and all, might very probably be found to anſwer to all the effects of the bark, of the larger kind alone. *Memoires Acad. Scien. Par.* 1736.

The ſaw-duſt of the oak has alſo been found, by ſeveral experiments made before the Society of Arts, &c. to anſwer full as well as the bark itſelf.

In the year 1729, a paper was printed and addreſſed to the Houſe of Commons in Ireland, containing an expeditious and cheap method of tanning without bark; upon which the houſe voted an immediate reward to the propoſer, Mr. William Maple, and promiſed him further encouragement. The ſubſtance of the above paper was as follows.

Oak bark, by its inſinuating into the pores, and incorporating with the ſubſtance of the hide, produces a firmneſs, ſtrength, and conſolidation of the parts: it muſt therefore ſtand to reaſon, that other vegetable materials, poſſeſſing the ſame apparent qualities, may probably produce the like effects, when applied to the ſame uſe.

Mr. Maple obſerves that tormentil and cinquefoil roots are ranged in the ſame medical claſs with oak bark, and have the ſame apparent qualities, eſpecially the firſt, in a more eminent degree than bark itſelf.

In the trials made in Ireland in this affair, by Mr. Maple and his friends, they were found to anſwer beyond expectation. The cinquefoil, it is true, did not give ſo good a colour as the tormentil, but in other reſpects tanned the hides well.

The tormentil, however, made ample amends; for in all reſpects, as to colour, bloom, ſubſtance, ſolidity, and weight, in the tanned hide, it completely anſwered, and in much leſs time than when bark, even of the beſt kind or growth, was uſed.

This aſſertion is by no means founded on a ſingle experiment, on which little dependence can be had: on the contrary, it is grounded on ſeveral years experience, and confirmed by the opinion and teſtimony of ſeveral tanners, and others, who were ſuppoſed (by the committee of the Houſe of Commons of Ireland, to whom the conſideration of the affair was referred by the houſe) to be good judges in a matter of this nature.

It may not be amiſs, to lay down a ſtate of what paſſed before the above committee, when this affair was coolly, impartially, and carefully enquired into, and the ſpecimens produced by Mr. Maple examined by all preſent with due attention.

The committee were pleaſed, for their greater ſatisfaction, to ſummon a great number of tanners, curriers, ſhoemakers, and others, to attend to give their teſtimony in relation to the ſeveral ſpecimens and proofs that were to be laid before them.

In reſpect to the goodneſs of the leather ſo tanned, the following ſpecimens were exhibited.

Number I. A calf's ſkin from the ooze.

Numb. II. A calf's ſkin uncurried.

Numb. III. A calf's ſkin curried.

(Each of theſe, when tanned and dried, weighing about three pounds.)

Numb. IV. A calf's ſkin, very ſtrong and large, when tanned and dried weighing about ſix pounds.

Numb. V. Seven or eight pair of ſoles, of a calf's ſkin raiſed.

Numb. VI. A bend of bullock's hide for harneſs.

Theſe were all proved, by Thomas Cooly and Patrick Shale, to be tanned without bark, and with the roots.

Mr. Henderſon, maſter of the tanners, ſaid he was diffident of the goodneſs of the ſpecimens; but that he ſhould have been thoroughly ſatisfied, had he known how the leathers had proved, if worn by ſome porters or chairmen; that the colour of Number II. or III. was not ſo good as ſome tanned with bark, producing a calf's ſkin curried, to compare with them; but did own all the ſpecimens were thoroughly ſtruck, and well tanned; that if they were in the ſhop, intermixed with ſkins tanned by bark, he could not diſtinguiſh them; and that what tanned Numb. V. and VI. would tan (time and quantity allowed) the thickeſt bullock's hide.

Mr. Dobſon, tanner, affirmed the ſpecimens were not well tanned, becauſe they did not come up to the colour of the ſkin produced by Mr. Henderſon; but in other reſpects, the leather appeared to be as good, in their reſpective kinds, as any tanned with bark.

Mr. Nicholas Gibton, maſter of the curriers, affirmed, that the ſkin produced by Mr. Henderſon was of an extraordinary colour; that there were not ten ſuch in Dublin; that the difference in colour was but very ſmall, and in regard even to colour, he would chuſe thoſe tanned by the vegetables as ſoon as Mr. Henderſon's ſkin; that all the ſpecimens appeared to be very well tanned; and that he could in no wiſe diſtinguiſh them from bark tannage.

Mr. Devereux, currier, being ſent out, returned and produced two calves ſkins tanned by the bark, which he took indifferently, and without chooſing, from the next currier's ſhop. They were allowed by all to be of a general, or common colour, and, being compared, were much exceeded by the ſpecimens, and particularly as to colour.

Mr. Edmund Shield, currier, ſaid he never ſaw better tanned leather than the ſpecimens; that their colour was very good; and that what tanned Numb. V. would tan any hide whatever.

Mr. Brookfield, tanner, reported, the ſpecimens exhibited were well tanned, and thoroughly ſtruck; that neither he, or any other, could diſtinguiſh them from bark tannage; and what tanned Numb. V. could not fail in any tannage.

Mr. Veckers, tanner, allowed the ſpecimens to be very well tanned, and gave it, as his opinion, that what tanned Numb. V. and VI. would tan the thickeſt ſole-leather.

Mr. John Gades, ſhoemaker, after giving his teſtimony that all the ſpecimens appear to be exceedingly well tanned, produced a ſhoe made by him of the leather of this tannage, affirming the leather wrought very well; and that the ſoles exhibited, under the hammer, all the ſigns of extraordinary leather.

Mr. Ellis, ſhoemaker, reported, the ſpecimens were very well tanned; that leather, either dead, or highly tanned, would never carry ſo beautiful a colour as leather otherwiſe tanned; that the ſole-leather appeared to be very well tanned; and that, in his opinion, this tannage would, in every reſpect, anſwer the ſame end, or intentions, as bark tannage.

Mr. King, ſhoemaker, ſaid all the ſpecimens were effectually tanned.

Mr. Richard Norris, ſhoemaker, produced a ſole of this tannage, beaten; aſſerting he never ſaw ſo good a ſole of raiſed calf's ſkin; that it beat firm, ſolid, and without ſpreading, or furzineſs, which are the diſtinguiſhing characters of good ſole-leather. He deſired it might be cut in ſeveral places, that the cloſeneſs and firmneſs might be viewed; which accordingly was done, and anſwering expectation, was approved.

There were a great many other tanners, curriers, and ſhoemakers, who were of the ſame opinion: but, conſidering their teſtimonies would be but ſo many repetitions, they need not be recited.

Dr. Richard Helſham, profeſſor of natural philoſophy in Trinity College, ſaid Mr. Maple had communicated to him what was uſed in this tannage, which appeared to him to be well adapted to tanning, and would not fail to give a ſufficient ſtrength and rigidity to the fibres; adding, he wore a pair of ſhoes, the upper leathers of this tannage, daily for four months, and, being

ing willing to try the utmoſt of the leather, he had new ſoles put to them; that ſince, he had worn them about a month; ſhewing them without any cracks or defect.

Patrick Carrol produced two ſlips of curried calf-ſkin, the one tanned by bark, the other by the roots, each three tenths of an inch broad, and ten inches long. The firſt was the thickeſt, and weighed a tenth part more than the other. He ſaid he was preſent, with ſeveral others, when it broke, by a weight of one hundred and twenty-nine pounds being hung to it; that the ſlip of this new tannage being tried with the ſame circumſtances, bore twenty-nine pounds more than the hundred and twenty-nine pounds, before it either yielded or broke.

In reſpect to time.

That the ſpecimens, Numb. I. II. and III. were tanned in five weeks, Numb. IV. in nine weeks, Numb. V. in four months, without any hurry extraordinary, or illegal methods, was proved by Mr. Thomas Cooley, and Patrick Shale. On the other ſide it appeared, that, in tanning with bark, from three to five months were required for calves ſkins; from ſeven to nine were requiſite for ſoles of raiſed calves ſkins; and from ten to thirteen months for bullocks hides, which, by this tannage, may be effected in nine or ten.

In regard to cheapneſs, part of the roots uſed were purchaſed at three farthings the pound; but afterwards Mr. Maple, being willing to engage the privacy of the gatherer, gave a penny: they loſe about a third in drying. Allowing theſe as facts, and taking it at the deareſt, leſs than five ſhillings worth of roots will go farther than a barrel, or four buſhels, of the beſt bark.

TANNING ENGINES, machines uſed by tanners for beating, cutting, and grinding tan, or the materials uſed in tanning. See TAN, and the preceding article.

The machine for cutting tan, as repreſented in plate CXXV. *fig.* 4 and 5. conſiſts of a long ſquare wooden block, which is beſt of oak or elm; and of ſome pieces of iron to be faſtened on it, and uſed about it, viz. an anvil, a hammer, an iron holding the wood to be bruiſed and cut, and a knife. A B, *fig.* 4. is the length of the block, being about four feet; C D the breadth, which is fifteen or ſixteen inches; E F the depth, eight or ten inches; G H I K a ſquare cavity to receive a plate of iron, ſerving for an anvil to beat and bruiſe the tanning materials upon; this is to be about four inches deep, nine inches broad, and twelve inches long; L M N O the iron for claſping and holding faſt the materials to be bruiſed and cut; which muſt lie croſs the engine, about the middle of the ſaid piece of timber, and may be about three inches broad; P Q are two hooks at one end of it, which are turned upwards, and muſt be hooked into the loops of the two hinges that are let in and faſtened to the ſides of the engine R S, in ſuch a manner that this claſping-piece may be a little raiſed for putting the tanning materials under it. At the ſide T, (*fig.* 5.) is a ſingle hook turned alſo upwards, to hang a weight upon it, whilſt the ſtuff is a bruiſing by the anvil, or a cutting by the knife. The button in *fig.* 4. ſerves to take up this piece by; *aaaa* on the other ſide of the block, *fig.* 5. are the places for the four feet of the engine, which are to be of a convenient height to work upon it. *b* (*fig.* 6.) is the hammer for beating and bruiſing the ſtuff, which may be of ſix pounds weight, and the head about three inches ſquare, to work with both hands; but for one hand, it may be made of three pounds weight, and the head about two inches ſquare: the ſurface of one end of theſe hammers ſhould be ſmooth, but that of the other indented. *c d*, *fig.* 4. the knife for cutting the bruiſed ſtuff, which muſt be eight or nine inches long, and near as much in breadth, made like a tobacco-knife, with a handle, and faſtened to the block at the two oppoſite ſides, that are to be hollowed, with two grooves, *e f g h*, *fig.* 5. and *i k l m*, *fig.* 4. with two pieces of iron fitted in the grooves, to hold and guide the knife in cutting. *n o p q*, *fig.* 4. is to be faſtened to the end of the knife *c*, by a pin *r*, paſſing through three holes; and this end is to be ſcrewed into the groove *e f g h*, *fig.* 5. by a couple of ſcrew-pins; the other piece, *ſ t u x y z*, *fig.* 4. being forked in, is to receive the other end of the knife *d*, and the ſolid ſquare part thereof, I K L M, is to be faſtened in the groove under it by two iron-plates *a a ε ε*, under which it muſt run in the ſaid groove ſo as to be ſlipped out from under it, and laid by when the machine is not uſed, when alſo the piece at the other end may be unſcrewed and laid up. The long ſquares upon one end of the block, viz. 5, 6, 7, 8, *fig.* 4. are two iron plates, to be faſtened where the knife, moving in a fit cavity, is to cut the bruiſed ſtuff between them; and of theſe plates that which lies next the end is to be laid a little lower, the block being there pared accordingly, that ſo the ſtuff may fall off from the end of the machine the quicker, as the left-hand ſupplies the bruiſed materials, whilſt the right-hand cuts them. Let the hollow place where the knife cuts be as near as poſſible, only large enough for the knife to riſe and fall eaſily; and let the block be hollowed under the cutting-hole, and ſloped off at that end, for the ſtuff to fall off, as it is cut by the knife.

The ſtuff being cut ſmall by the engine, is to be well dried again on a kiln, and then ground into a coarſe powder upon the mill, being a large round wooden trough with a pretty large ſtone ſet on edge in it, and turned round by a horſe, as repreſented *fig.* 7.

TANTALUS's CUP, in hydraulics, a ſiphon ſo adapted to a cup, that the long leg may go down through the bottom of the cup.

This bended ſiphon is called Tantalus's cup, from the reſemblance of the experiment made with an image in the glaſs, repreſenting Tantalus in the fable, fixed up in the middle of the cup with a ſiphon concealed in his body, beginning in the bottom of his feet, and aſcending to the upper part of his breaſt; there it makes a turn, and deſcends through the other leg, on which he ſtands; and from thence through the bottom of the cup, where it runs out, and cauſes the water to ſubſide in the cup: as ſoon as it riſes to the height of the ſiphon, or to the chin of the image, which is above S *s*, (plate CXXV. *fig.* 8.) the water will begin to run through the ſiphon concealed in the figure, till the cup is emptied in the manner explained under Siphon, and repreſented more diſtinctly in *fig.* 9.

Sometimes the Tantalus's cup is made without a figure fixed in it, as *fig.* 10. where the water being up at S *s*, the cup does not run; but as ſoon as the figure, or an apple, or orange, &c. is thrown in, the water begins to run out at the foot of the cup, and does not ceaſe till the whole cup is empty. This happens becauſe the body thrown into the cup, raiſes the water's ſurface from S *s* to B C, where being above the upper end S of the pipe S P concealed in the handle, which thereby is made a ſiphon, the water which is come into the handle at O runs into the middle pipe at S, and ſo out at P, under the foot, ſo long as there is any water above O.

TANTAMOUNT, ſomething that amounts, or is equivalent, to ſome other.

TAPER, TAPERING, is underſtood of a piece of timber, or the like, when broad at one end gradually diminiſhing to the other, as is the caſe in pyramids, cones, &c.

TAPER BOARD, is applied to a piece of ordnance when it is wider at the mouth than towards the breech.

TAPER alſo denotes a kind of tall wax candle placed in a candleſtick, and burnt at funeral proceſſions, and in other church ſolemnities. Tapers are made of different ſizes; in ſome places, as Italy, &c. they are conical or taper; both kinds are pierced at the bottom for a kind of pin in the candleſtick to enter. For the method of making tapers, both by the ladle and by the hand, ſee the articles CANDLE and FLAMBEAU.

Paſchal TAPER, among the Romaniſts, a large taper whereon the deacon applies five bits of frankincenſe in holes made for the purpoſe in form of a croſs, and which he lights with new fire in the ceremony of Eaſter-Sunday.

TAPESTRY, or TAPISTRY, a curious kind of manufacture, ſerving to adorn a chamber or other apartment, by covering or lining the walls thereof. It is a kind of woven hangings of wool and ſilk, frequently raiſed and enriched with gold and ſilver, repreſenting figures of men, animals, landſkips, hiſtories, &c.

The invention of tapeſtry ſeems to have come to us from the Levant; and this ſeems the more probable, in that the workmen concerned in it were called, at

leaſt in France, Sarraſins, or Sarraſinois. It is ſuppoſed that the Engliſh and Flemiſh, who were the firſt that excelled in making tapeſtry, might bring the art with them from ſome of the croiſades, or expeditions againſt the Saracens. Be this as it will, it is certain that theſe two nations, eſpecially the Engliſh, were the firſt who ſet on foot this noble and rich manufacture in Europe, now one of the fineſt ornaments of palaces, churches, &c. and therefore if they may not be allowed the inventors, they have at leaſt the glory of being the reſtorers of this ſo curious and admirable an art, as gives a kind of life to wools and ſilks, in no reſpect inferior to the paintings of the beſt maſters.

Tapeſtry-work is diſtinguiſhed by the workmen into two kinds, viz. that of high, and that of low warp; though the difference is rather in the manner of working than in the work itſelf; which is in effect the ſame in both; only the looms, and conſequently the warps, are differently ſituated; thoſe of the low warp being placed flat and parallel to the horizon, and thoſe, on the contrary, of the high warp erected perpendicularly. The Engliſh anciently excelled all the world in the tapeſtry of the high warp, and they ſtill retain their former reputation, though with ſome little change: their low warps are ſtill admired; but, as for the high ones, they are quite laid aſide by the French. The French have three conſiderable tapeſtry-manufactures beſides that of the Gobelins; the firſt at Aubuſſon in Auvergne, the ſecond is at Felletin in the Upper Marche, and the third at Beauvais. They were all equally eſtabliſhed for the high and the low warp; but they have all laid aſide the high warp, except the Gobelins. There are admirable low warps in Flanders, generally exceeding thoſe of France; the chief and almoſt only Flemiſh manufactures are at Bruſſels, Antwerp, Oudenard, Liſle, Tournay, Bruges, and Valenciennes.

The uſual widths of tapeſtries are from two ells to three ells Paris meaſure.

The Manufacture of TAPESTRY *of the high warp.*— The loom, whereon it is wrought, is placed perpendicularly: it conſiſts of four principal pieces; two long planks or cheeks of wood, and two thick rollers or beams. The planks are ſet upright, and the beams acroſs them, one at the top, and the other at the bottom, or about a foot diſtance from the ground. They have each their trunnions, by which they are ſuſpended on the planks, and are turned with bars. In each roller is a groove from one end to the other, capable of containing a long round piece of wood, faſtened therein with hooks. The uſe of it is to tie the ends of the warp to. The warp, which is a kind of worſted, or twiſted woollen thread, is wound on the upper roller; and the work, as faſt as wove, is wound on the lower. Withinſide the planks, which are ſeven or eight feet high, fourteen or fifteen inches broad, and three or four thick, are holes pierced from top to bottom, in which are put thick pieces of iron, with hooks at one end, ſerving to ſuſtain the coat-ſtave; theſe pieces of iron have alſo holes pierced, by putting a pin, in which the ſtave is drawn nearer or ſet farther off; and thus the coats or threads are ſtretched or looſened at pleaſure. The coat-ſtave is about three inches diameter, and runs all the length of the loom; on this are fixed the coats or threads, which make the threads of the warp croſs each other. It has much the ſame effect here, as the ſpring-ſtave and treddles have in the common loom. The coats are little threads faſtened to each thread of the warp with a kind of ſliding knot, which forms a ſort of maſk or ring. They ſerve to keep the warp open for the paſſage of broaches wound with ſilks, woollens, or other matters uſed in the piece of tapeſtry. In the laſt place, there are a number of little ſticks of different lengths, but all about an inch in diameter, which the workman keeps by him in baſkets, to ſerve to make the threads of the warp croſs each other, by paſſing them acroſs: and, that the threads thus croſſed may retain their proper ſituation, a packthread is run among the threads, above the ſtick.

The loom being thus formed, and mounted with its warp, the firſt thing the workman does, is to draw on the threads of this warp, the principal lines and ſtrokes of the deſign to be repreſented on the piece of tapeſtry; which is done by applying cartoons, made from the painting he intends to copy, to the ſide that is to be the wrong ſide of the piece, and then, with a black-lead pencil, following and tracing out the contours thereof on the thread of the right-ſide; ſo that the ſtrokes appear equally both before and behind.

As for the original deſign the work is to be finiſhed by, it is hung up behind the workmen, and wound on a long ſtaff from which a piece is unrolled from time to time, as the work proceeds.

Beſides the loom, &c. here deſcribed, there are three other principal inſtruments required for working the ſilk or the wool of the woof within the threads of the warp; theſe are a broach, a reed, and an iron-needle.

The broach is made of a hard wood, ſeven or eight inches long, and two thirds of an inch thick, ending in a point with a little handle. This ſerves as a ſhuttle; the ſilks, woollens, gold, or ſilver to be uſed in the work, being wound on it.

The reed or comb is alſo of wood, eight or nine inches long, and an inch thick on the back, whence it grows leſs and leſs to the extremity of the teeth, which are more or leſs apart, according to the greater or leſs degree of fineneſs of the intended work. Laſtly, the needle is made in form of the common needle, only bigger and longer. Its uſe is to preſs cloſe the wool and ſilks when there is any line or colour that does not fit well.

All things being prepared for the work, and the workman ready to begin, he places himſelf on the wrong ſide of the piece, with his back towards the deſign; ſo that he works as it were blind-fold, ſeeing nothing of what he does, and being obliged to quit his poſt, and go to the other ſide of the loom, whenever he would view and examine the piece, to correct it with his preſſing needle. To put ſilk, &c. in the warp, he firſt turns and looks at the deſign, then, taking a broach full of the proper colour, he places it among the threads of the warp, which he brings croſs each other with his fingers, by means of the coats or threads, faſtened to the ſtaff; this he repeats every time he is to change his colour. Having placed the ſilk or wool, he beats it with his reed or comb; and when he has thus wrought in ſeveral rows over each other, he goes to ſee the effects they have, in order to reform the contours with his needle, if there be occaſion. As the work advances, it is rolled upon the lower beam, and they unrol as much warp from the upper beam, as ſuffices them to continue the piece: the like they do of the deſign behind them. When the pieces are wide, ſeveral workmen may be employed at once.

We have but two things to add: the firſt is, that the high-warp tapeſtry goes on much more ſlowly than the low-warp, and takes up almoſt twice the time and trouble. The ſecond is, that all the difference that the eye can perceive between the two kinds, conſiſts in this, that in the low-warp there is a red fillet, about one twelfth of an inch broad, running on each ſide from top to bottom, which is wanting in the high warp.

But, for the ſatisfaction of our readers, we ſhall here preſent them with a repreſentation of the loom for the manufacture of tapeſtry of the high-warp, or that in a ſituation perpendicular to the horizon. See plate CXXVI. *fig.* 1. where 1, 1, repreſent the loom poſts, or the thick planks, which ſupport the rollers. 2. The rollers; the upper end holds the chain, the lower holds the tapeſtry, which is rolled upon it, according as the work goes forward: the threads are faſtened at their ends to a dweet, or thick rod, which is lodged in a groove made on each roller. 3. The two tantoes; one called the great tantoe, for turning the upper roller; the other the little tantoe, for turning the lower roller. 4. The pole of the leiſhes, which runs quite acroſs the chain, takes up all the leiſhes, and brings them to the workman's hand. Theſe leiſhes are little ſtrings, tied by a ſlip-knot to each thread of the chain, to be raiſed up according as the chain ſinks down; they ſerve to draw the particular thread which the weaver wants: he holds the thread ſeparate from the reſt, and paſſes a ſpindle of ſuch a woof and colour as he thinks proper; then he lets the ſpindle hang down, and hinders the thread from running off, by a ſlip knot. After having taken one or two threads of the forepart of the chain by another leiſh, he

brings the threads of the oppoſite ſide to him. By this alternative work he conſtantly makes them croſs one another, to take in and ſecure the woof. In order to diſtinguiſh the threads of both ſides, he is aſſiſted by the croſs rod, which is put between two rows of threads. 5. A long tract of dots formed by the ends of the leiſhes, which take hold of the leiſhes of the chain by a ſlip-knot; and on the other hand encompaſs the pole of the leiſhes. 6. The croſs-rod. 7. A little chain, each loop of which contains four or five threads of the warp, and keeps them perpendicular. 8. An iron-hook, to ſupport the pole of the leiſhes. 9, 9, 9. The broacher-quill, to paſs the threads of the woof, which is wound on it. 10. The comb, to ſtrike in the work. 11. The end of the dweet let into the roller, in a groove.

When the chain is mounted, the draughtſman traces the principal out-lines of the picture, which is to be wrought, with black chalk, on the fore and back ſide of the chain. The weaver in the upright way having prepared a good ſtock of quills, filled with threads of all colours, goes to work, placed on the back part, as in the flat way, or in the manufacture of the low-warp. He has behind him his drawings, on which he frequently looks, that he may from time to time ſee how his work ſucceeds on the right or fore-ſide, which the other cannot do.

The Manufacture of TAPESTRY *of the Low-warp.* The loom or frame wherein the low-warp is wrought, is much like that of the weavers; the principal parts thereof (*fig.* 2.) are two ſtrong pieces of wood, forming the ſides of the loom, and bearing a beam or roller at each end; they are ſuſtained at bottom with other long pieces of wood, in manner of treſſels; and, to keep them the firmer, are likewiſe faſtened to the floor, with a kind of buttreſſes, which prevent any ſhaking, though there are ſometimes four or five workmen leaning on the beam at once. The rollers have each their trunnions, by which they are ſuſtained; they are turned by large iron-pins, three feet long. Along each beam runs a groove, in which is placed the wich, a piece of wood above two inches diameter, and almoſt the length of the roller. This piece fills the groove intirely, and is faſtened therein, from ſpace to ſpace, by wooden-pins. To the two wiches are faſtened the two extremities of the warp, which is wound on the further roller, and the work, as it advances, on the nearer. Acroſs the two ſides, almoſt in the middle of the loom, paſſes a wooden bar, which ſuſtains little pieces of wood, not unlike the beam of a ballance: to theſe pieces are faſtened ſtrings, which bear certain ſpring ſtaves, wherewith the workman, by means of two treddles under the loom, on which he ſets his feet, gives a motion to the coats, and makes the threads of the warp riſe and fall alternately. Each loom has more or fewer of theſe ſpring-ſtaves, and each ſtaff more or fewer coats, as the tapeſtry conſiſts of more or fewer threads. The deſign or painting the tapeſtry-man is to follow, is placed underneath the warp, where it is ſuſtained from ſpace to ſpace with ſtrings, by which the deſign is brought nearer to the warp. The loom being mounted, there are two inſtruments uſed in working of it, viz. the reed and the flute.

The flute does the office of the weaver's ſhuttle: it is made of a hard poliſhed wood, three or four lines thick at the ends, and ſomewhat more in the middle, and three or four inches long. On it are wound the ſilks, or other matters, to be uſed as the woof of the tapeſtry, repreſented. The comb, or reed, is of wood or ivory: it has uſually teeth on both ſides; it is about an inch thick in the middle, but diminiſhes each way to the extremity of the teeth; this ſerves to beat the threads of the woof cloſe to each other, as faſt as the workman has paſſed and placed them, with his flute, among the threads of the warp; as repreſented at 10, *fig.* 1.

The workman is ſeated on a bench before the loom, with his breaſt againſt the beam, only a cuſhion or pillow between them; and in this poſture ſeparating with his fingers the threads of the warp, that he may ſee the deſign underneath; and taking a flute, wound with the proper colour, he faſtens it among the threads, after having raiſed or lowered them, by means of the treddles, moving the ſpring ſtaves and coats.

Laſtly, to preſs and cloſe the threads of the ſilk or yarn, &c. thus placed, he ſtrikes each courſe, i. e. what the flute leaves in its paſſing and coming back again, with the reed.

That which is very remarkable in the manufacture of the low-warp, and which is common to it with the high, is, that it is all wrought on the wrong ſide; ſo that the workman cannot ſee the right ſide of his tapeſtry, until the piece is finiſhed, and taken out of the loom.

TAPLINGS, in the Engliſh ſalt-works, the name given to certain bars of iron, which ſupport the bottom of the pan in which the brine is boiled.

Theſe pans are very large, and cover a wide furnace; but as their width would make them apt to bend in the middle, which would ſpoil the working of the ſalt, there is a ſort of wall made of brick carried along the middle of the furnace, and on the top of this are placed theſe taplings; they are about eight inches high, and from four to ſix in thickneſs, being ſmalleſt at the top. Theſe are placed at about three foot diſtance one from another, and the wall which ſupports them, and which is called the midfeather, is broad at the baſe, and ſo narrow at the top, as barely to give room for the baſes of the taplings.

TAPPING, in general, the act of piercing an hole in a veſſel, and applying a tube or cannula in the aperture, for the commodious drawing off the liquors contained therein.

Tapping, in agriculture, is the making an inciſion in the bark of a tree, and letting out the juice. To tap a tree at the root, is to open it round about the root. In the tapping of trees, the juice taken in from the earth, aſcends from the root; and, after it is concocted and aſſimilated in the branches, &c. it deſcends, like a liquor in an alembic, to the orifice or inciſion, where it iſſues out. One of the moſt effectual ways of tapping, ſo as to obtain the greateſt quantity of ſap, and that in the ſhorteſt time, is not only to pierce the bark, or to cut the body of the tree almoſt to the pith with a chiſſel, as ſome have directed, but to bore through all the circles on both ſides the pith, leaving only the outermoſt circle and the bark on the north-eaſt ſide unpierced. This hole is to be bored ſloping upwards, as large as the largeſt auger will make; and that alſo through, and under a large arm near the ground; and thus it will not need any ſtone to keep open the orifice, nor tap to direct the ſap into the receiver. This way the tree will, in a ſhort time, afford liquor enough to brew withal: and with ſome of this ſweet ſap, one buſhel of malt is ſaid to make as good ale as four buſhels of malt with ordinary water. The large maple, called the ſycamore, is ſaid to yield the beſt brewing ſap, its juice being very ſweet and wholeſome. It is affirmed that the liquor which may be drawn from a birch, in the ſpring-time, is equal to the whole weight of the tree, branches, root, and all together.

To preſerve the ſap for brewing, inſolate it by a conſtant expoſure to the ſun, in proper veſſels, till the reſt be gathered and ready, otherwiſe it will contract an acidity. When there is enough, put into it as much very thin cut and hard-toaſted rye-bread, as will ſerve to ferment it; and when it works, take out the bread, and bottle up the liquor. A few cloves in each veſſel that receives the ſap, as it oozes from the tree, will alſo preſerve it a twelve-month.

TAPPING, in ſurgery. See the article PARACENTESIS.

TAPUYERS, and TAPINAMBES, two numerous tribes which the Portugueſe found in Braſil, in South America, when they planted that country.

TAR, a thick, black, reſinous, very adheſive juice, melted out by fire from old pines and fir-trees. The trees, cut in pieces, are incloſed in a large oven, which being heated by a fire on the out ſide, or the wood itſelf kindled and ſmothered, the juice runs off by a canal at the bottom.

Tar differs from the turpentine or native reſinous juice of the trees in having received a diſagreeable empyreumatic impreſſion from the fire; and in containing, along with the pungent bitter terebinthinate matter, a portion of the acid which is extricated from the wood by the heat, and likewiſe of its gummy or mucilaginous matter.

By

By the mediation of these principles, a part of the terebinthinate oil and resin becomes dissoluble in watery liquors, which extract little or nothing from the purer turpentines.

Water impregnated with the more soluble parts of tar has been recommended as a remedy for almost all diseases. The proportions that have been commonly followed are, two pounds of tar to a gallon of water; which are to be well stirred together, then suffered to settle for two days, and the clear liquor poured off for use. It is observed, "That tar-water, when right, is not paler than French, nor deeper-coloured than Spanish white wine, and full as clear: if there be not a spirit very sensibly perceived in drinking, the tar-water is not good. It may be drank either cold or warm. As to the quantity, in common chronical indispositions a pint a day may suffice, taken on an empty stomach, at two or four times: more may be taken by strong stomachs. But those who labour under great and inveterate maladies, must drink a greater quantity, at least a quart every twenty-four hours. In acute cases, it must be drank in bed warm, and in great quantity, the fever still enabling the patient to drink, perhaps a pint every hour." Though this medicine is undoubtedly very far inferior to the character that has been given of it, it is apparently capable of answering important purposes, as a deobstruent balsamic solution, moderately warm and stimulating. It sensibly raises the pulse, and increases either perspiration or the grosser evacuations; and we are informed of some late instances of its good effects in disorders of the leprous kind.

Some have imagined the acid to be the principle that gives virtue to tar-water, and hence have endeavoured to introduce, instead of the infusion, an acid spirit extracted from tar by distillation. But the effects of this, as of other acids, are opposite to those experienced from tar-water; nor does the acid of tar differ from that which is extricated by fire from all kinds of recent wood. Tar-water, distilled, yields a liquor very considerably impregnated with its flavour, though more grateful than the infusion itself both in smell and taste; there remains a light, spongy, blackish substance, not acid but bitter, partially dissoluble again in water.

This juice is sometimes given also in substance, mixed with so much powdered liquorice, or other like powdery matters, as is sufficient to render it of a due consistence for being formed into pills. An ointment, made by melting it with an equal weight of mutton suet, and straining the mixture whilst hot, is sometimes used as a digestive, and said to be particularly serviceable against scorbutic and other cutaneous eruptions.

On inspissating tar, or boiling it down to dryness without addition, it gives over an acid liquor in considerable quantity, and an ethereal oil of the same general nature with that of turpentine, but impregnated with the empyreumatic flavour of the tar. The solid residuum is the common pitch. This is less pungent and less bitter than the liquid tar, and is used only in some external applications, as a warm adhesive resinous substance. Neumann observes, that when melted with oils, resins, and fats, into ointments and plasters, the pitch is greatly disposed to separate and precipitate.

Tar is likewise used for coating and caulking ships, and many other intentions at sea.

TAR-WATER.—In some parts of America, tar-water is made by putting a quart of cold water to a quart of tar, and stirring them well together in a vessel, which is left standing till the tar sinks to the bottom. A glass of clear water, being poured off for a draught, is replaced by the same quantity of fresh water, the vessel being shaken, and left to stand as before. And this is repeated for every glass, so long as the tar continues to impregnate the water sufficiently, which will appear by the smell and taste.

But, as this method produces tar-water of different degrees of strength, Bishop Berkley says, he chuses to make it in the following manner: pour a gallon of cold water on a quart of tar, and stir and mix them thoroughly with a ladle or flat stick, for the space of three or four minutes; after which the vessel must stand eight and forty hours, that the tar may have time to subside; when the clear water is to be poured off, and kept for use, no more being made from the same tar, which may still serve for common purposes.

It has been found, that several persons infected with cutaneous eruptions and ulcers were immediately relieved, and soon after cured, by the use of this medicine. It is said, that, even in the foulest distempers, it proved much more successful than salivations and wood-drinks had done. It also succeeded, beyond expectation, in a tedious and painful ulceration of the bowels, in a consumptive cough, and, as appeared by expectorated pus, an ulcer in the lungs, in a pleurisy and peripneumony. And, when a person who had been for some years subject to erysipetalous fevers, perceived the usual forerunning symptoms to come on, the drinking of tar-water prevented the erysipelas.

Tar-water cures indigestion, and gives a good appetite. It is an excellent medicine in an asthma; it imparts a kindly warmth and quick circulation to the juices, without heating, and is therefore useful, not only as a pectoral and balsamic, but also as a powerful and safe deobstruent in cachectic and hysteric cases. As it is both healing and diuretic, it is very good for the gravel. The bishop says, he believes it to be of great use in a dropsy, having known it cure a very bad anasarca in a person whose thirst, though very extraordinary, was in a short time removed by the drinking of tar-water. It may likewise be safely used in inflammatory cases; and, in fact, hath been found an admirable febrifuge, at once the safest cooler and cordial.

To sailors, and all sea-faring persons, who are subject to scorbutic disorders, and putrid fevers, especially in long southern voyages, he is persuaded this tar-water would be very beneficial.

It is to be observed, that tar-water should not be made in unglazed earthen vessels, these being apt to communicate a nauseous sweetness to the water.

The same ingenious author recommends tar-water in the plague, and for the distemper among the horned cattle; with what success must be left to experience.

TARANTISMUS, in medicine, the disease or affection of those bit by the tarantula.

TARANTULA, in the history of insects, a species of araneus, with an oval hairy body and thick legs.

This is one of the large spiders, but is not the very largest known: its body is three quarters of an inch long, and of the thickness of one's little finger; it is usually of an olive brown, variegated with a duskier colour; but in this it varies greatly: it is covered with a short and soft down, or hairiness; the points of its forceps are very fine and sharp: this species is a native of Apulia.

As to the effects of the poison they convey into the wound they make, there seems yet room for much explanation about it. We are told, that in the summer months, especially when the heats are greatest, as in the dog-days, the tarantula, creeping among the corn in the fields, bites the mowers and passengers: that in the winter it lurks in holes, and is scarcely seen; and that if it bites then, it is not so venomous, neither does it induce any ill symptoms: but in hot-weather, according to Dr. Mead, although the pain of its bite is at first no greater than what is caused by the sting of a bee, yet the part is quickly after discoloured with a livid, black, or yellowish circle, and raised to an inflamed swelling; the patient within a few hours is seized with a violent sickness, difficulty of breathing, universal faintness, and sometimes trembling, with a weakness in the head; and on being asked his ailment, with a tremulous voice, and melancholy look, points to his breast, as if the heart was most affected: the patient grows by degrees more melancholy, stupid, and strangely timorous, and in a short time expires, unless music is called to his assistance, which alone, without the help of medicines, is said to perform the cure, the usual alexipharmics and cordial medicines being of no service: for at the first sound of the musical instrument, although the sick lie as it were in an apoplectic fit, they begin by degrees, to move their hands and feet, till at last they get up, and fall to dancing, with wonderful vigour at first, for three or four hours; then they

they are put to bed, refreſhed from their ſweating a ſhort time, and repeat their exerciſe with the ſame vehemence, perceiving no wearineſs or weakneſs from it, but profeſſing that they grow ſtronger and nimbler the more they dance. At this ſport they uſually ſpend twelve hours a day; and it continues three or four days, by which time they are freed from all their ſymptoms; which, nevertheleſs, attack them about the ſame time next year; and if they do not take care to prevent this relapſe by muſic, they fall into the jaundice, want of appetite, univerſal weakneſſes, and ſuch like diſeaſes, which are every year increaſed, if dancing be neglected, till at laſt they prove incurable. As muſic is the common cure, ſo they who are bitten are pleaſed, ſome with one ſort of it, and ſome with another; one is pleaſed with a pipe, another with a timbrel, one with a harp, and another with a fiddle; ſo that the muſicians ſometimes make ſeveral eſſays before they can accommodate their art to the venom; but this is conſtant and certain, notwithſtanding this variety, that they all require the quickeſt and briſkeſt tunes; and are never moved by a ſlow dull harmony. While the Tarantati are dancing, they loſe in a manner the uſe of all their ſenſes, are like ſo many drunkards, do many ridiculous and fooliſh tricks, talk and act obſcenely and rudely, take great pleaſure in playing with vine-leaves, with naked ſwords, red cloaths, and the like; and, on the other hand, cannot bear the ſight of any thing black; ſo that if any byſtander happen to appear in that colour, he muſt immediately withdraw, otherwiſe they relapſe into their ſymptoms with as much violence as ever. Baglivi, who reſided in Italy, and probably had good opportunities of informing himſelf with reſpect to this inſect, has written a treatiſe expreſly upon the ſubject: and moſt medicinal writers mention the diſtempers ariſing from the bite thereof, as a thing certain.

But, notwithſtanding all theſe great authorities, there is good reaſon to believe the whole ſtory fabulous, and a vulgar error; for it is treated as ſuch by an Italian phyſician, in the Philoſ. Tranſ. and a great many gentlemen of unqueſtionable veracity, who reſided at Taranto many months, and during the time in which the bite of a tarantula is ſaid to be moſt pernicious, affirm, that there was not a phyſician in the country, who believed there ever was ſuch a diſtemper, from ſuch a cauſe: that among the vulgar there is a tradition, that diſtempers attended with very extraordinary circumſtances, had been excited by the bite of a tarantula; but that no body ever remembers a ſingle inſtance; and that there is no other ſpider to be found in that country, different from thoſe which are common in moſt warm countries.

TARANTOLA-Fish, a ſpecies of oſmerus, with eleven rays in the pinna ani.

This fiſh is of the ſize of the ſmelt, or larger; the body is rounded, and the belly flat; its thickneſs is about that of a man's thumb, when its length is ſeven inches; the belly is white, the head is flatted, and there is a little furrow between the eyes; the opening of the mouth is very large, and the roſtrum acute; there is in each jaw a ſingle ſeries of long teeth on each ſide of the palate; the back fin has twelve rays, and there is towards the extremity of the back a membranous appendage of the appearance of a fin, but without any rays; the pectoral fins have each thirteen rays.

TARE, is an allowance for the outſide package, that contains ſuch goods as cannot be unpacked without detriment; or for the papers, threads, bands, &c. that incloſe or bind any goods imported looſe; or, though imported in caſks, cheſts, &c. yet cannot be unpacked and weighed net. Several ſorts of goods have their tares aſcertained, and thoſe are not to be altered or deviated from, in any caſe, within the port of London; unleſs the merchant thinking himſelf, or the officers of the crown, to be prejudiced by ſuch tares, ſhall deſire that the goods may be unpacked, and the net-weight taken; which may be done either by weighing the goods in each reſpective caſk, &c. net; or, as is practiſed in Eaſt-India goods particularly, by picking out ſeveral caſks, &c. of each ſize, and making an average, compute the reſt accordingly. But this muſt not be done without the conſent of two ſurveyors, atteſted by their hands in the landwaiter's books; and in the out ports, not without the conſent of the collector and ſurveyor. And as to thoſe goods which have not their tares aſcertained, two ſurveyors in London, and the collector and ſurveyor in the out-ports, are to adjuſt and allow the ſame, in like manner. Sometimes the caſks, &c. are weighed beyond ſea, before the goods are put in; and the weight of each reſpective caſk, &c. marked thereon, as is uſual for moſt goods imported from the Britiſh plantations, or elſe inſerted in the merchant's invoice; in which caſe, if the real invoice be produced, and the officers have ſatisfied themſelves, by unpacking and weighing ſome of them, that thoſe weights are juſt and true, they do then, after having reduced them to Britiſh weight, eſteem them to be the real tares, and paſs them accordingly. But the unpacking goods, and taking the net-weight, being ſuppoſed the juſteſt method, both for the crown and merchant, it is uſually practiſed in the port of London, in all caſes where it can be done with conveniency, and without detriment to the goods.

TARGET, a kind of ſhield or weapon of defence made uſe of by the ancients.

TARGUM, a name whereby the Jews call the Chaldee paraphraſes, or expoſitions, of the Old Teſtament, in the Chaldee language. After the captivity, the Jewiſh doctors, in order to make the people underſtand the Holy Scripture, which was read in Hebrew in their ſynagogues, were obliged to explain the law to them in a language they underſtood, which was the Chaldean, or that uſed in Aſſyria. The Targums now remaining, were compoſed by different perſons, upon different parts of ſcripture, and are eight in number.

TARIF, or Tariff, a table or catalogue, containing the names of different ſorts of merchandize, with the duties to be paid, as ſettled by authority, amongſt trading nations.

TARPAULIN, a piece of canvas, well tarred over, to keep out the rain from any place. The term is alſo uſed in deriſion to a perſon bred at ſea, and educated in the mariner's art.

TARRACE, or Terrace, a kind of plaſter or mortar. See Terrace.

TARSO, in the glaſs-trade, a white kind of ſtone, uſed inſtead of ſand, for the fineſt cryſtal. See the article Glass.

TARSUS, in anatomy, is the ſpace between the bones of the leg and the metatarſus, conſiſting of ſeven bones, viz. the aſtragalus, or talus, calcaneum, naviculare, three oſſa cuneiformia, and the cubiforme.

Tarsus is alſo a name given, by ſome anatomiſts, to the cartilages which terminate the palpebræ, or eyelids, and from which the cilia or hairs ariſe.

They are exceedingly thin and fine, which makes them light and flexible.—Their form is ſemi-circular; that of the upper eye-lid is ſomewhat longer than that of the under: they ſerve alike to cloſe the eyes.

TARTANE, a kind of bark uſed for fiſhing and carriage: they are fluſh fore and aft, and commonly uſe oars. They are plenty in the Mediterranean: they have only a main-maſt and a mizen: their ſails are triangular. When they put up a ſquare ſail, it is called a ſail of fortune.

TARTAR, *Tartarum*, an acid concrete ſalt, thrown off from wines, after complete fermentation, to the ſides and bottoms of the caſks; of a red or white colour, and more or leſs droſſy, according to the colour and quality of the wine. The white is generally purer than the red: both kinds, when purified, are exactly the ſame.

This ſalt is one of thoſe which are moſt difficultly diſſoluble in water, being ſcarcely affected by it in the cold, and requiring ten or twelve times its own weight when aſſiſted by a boiling heat. From this ſaturated ſolution the tartar begins to ſeparate almoſt as ſoon as the boiling ceaſes: if the quantity of water is greater, as about twenty times the weight of the ſalt, it continues long enough ſuſpended to be paſſed, with due care, through a woollen ſtrainer or a filter. The filtered liquor appears limpid and colourleſs, whether the tartar made uſe of was red or white: if haſtily cooled, the ſalt ſeparates in ſmall grains like ſand, but if the veſſel is cloſely covered,

and the heat very leiſurely diminiſhed, it ſhoots into ſemitranſparent white cryſtals: if the filtered liquor be kept boiling, a thick ſkin forms on the ſurface, which, being taken off with a perforated wooden ſkimmer, is ſucceeded by freſh cuticles, till the whole of the ſalt is thus formed into what is called creme of tartar. The refining of tartar is practiſed, in the way of trade, chiefly about Montpelier, from whence the ſhops are generally ſupplied both with the cryſtals and creme; the proceſs being ſo troubleſome, and requiring ſo large conveniencies, that it is ſcarcely ever attempted here. The purer ſort of white tartar, unrefined, eſpecially that of Rheniſh wine, is, for many purpoſes, particularly for combinations with other bodies, not inferior either to the creme or cryſtals.

Pure tartar, in doſes of half a dram, or a dram, is a mild cooling aperient: two or three drams gently looſen the belly; and ſix or eight prove moderately cathartic. Its acidity and laxative power are its medical characters.

Tartar, diſſolved in water, effervesces with fixed alcaline ſalts, and ſaturates, of the vegetable alcalies, near one third its own weight. The compound ſalt, reſulting from their union, is a neutral one, more purgative than the tartar itſelf, and far eaſier of ſolution, whence its name ſoluble tartar. This ſalt is prepared, either by boiling the refined tartar in ten times its weight of water till it is diſſolved, and then dropping in ſtrong alcaline ley; or by diſſolving the alcali in boiling water in the proportion of a pound to a gallon, and then adding the tartar, till a freſh addition occaſions no further effervescence: the liquor is then filtered while hot, and either cryſtallized, or evaporated to dryneſs. As this ſalt difficultly cryſtallizes, inſpiſſation to dryneſs is the moſt convenient method; and in this caſe, to ſecure the perfect neutralization of the ſalt, the tartar ſhould be made to prevail at firſt, and the liquor ſuffered to cool a little before filtration, that the redundant tartar may concrete and ſeparate from it.

Of the mineral fixed alcali or ſoda, this acid ſaturates, according to the faculty of Paris, four fifths its own weight. The neutral ſalt reſulting from its coalition with this alcali, is ſomewhat leſs diſſoluble than that with the vegetable; and ſhoots much more eaſily, into pretty large hard, multangular cryſtals, ſome columnar and flattiſh, others more irregular. It is milder in taſte, and in virtue leſs purgative, requiring to be given to the quantity of an ounce or an ounce and a half to purge effectually: eight drams ſeem to be about equivalent, in cathartic power, to ſix of the ſoluble tartar.

Tartar forms likewiſe ſoluble compounds with all the abſorbent earths, and with ſome metallic bodies; but with theſe laſt it is difficultly made to ſatiate itſelf completely, the part that is firſt ſaturated ſeeming to impede the action of the reſt; for after long boiling, a very conſiderable part of the tartar ſeparates on cryſtallization unchanged.

It is obſervable, that if any of theſe combinations of tartar, with alcalies, with earths, or with metals, be diſſolved in water, and any other acid added, the pure tartar ſeparates and falls to the bottom, as acid, and as difficult of ſolution, as at firſt; the ſubſtance, that was combined with it, being abſorbed by the acid ſuperadded. As the acids of the vegetable kingdom, whether native or fermented, vinegar, lemon juice, tamarinds, &c. have this effect of diſuniting tartar from all the bodies that are combinable with it, equally with thoſe of the mineral kingdom; it follows, that the tartareous acid is of a kind eſſentially different from all the other known vegetable ones, and that no acid, unleſs it be tartar itſelf, can be joined in preſcription to the *tartarum ſolubile*, the *ſel de Seignette*, or the combinations of tartar with earths or metals.

TARTARY, a vaſt country in the northern parts of Aſia, bounded by Siberia on the north and weſt: this is called Great Tartary. The Tartars who lie ſouth of Moſcovy and Siberia, are thoſe of Aſtracan, Circaſſia, and Dageſtan, ſituated north-weſt of the Caſpian ſea: the Calmuc Tartars, who lie between Siberia and the Caſpian ſea: the Uſbec Tartars and Moguls, who lie north of Perſia and India: and, laſtly, thoſe of Tibet, who lie north-weſt of China.

TASSEL, a ſort of pendent ornament at the corners of a cuſhion or the like.

In building, taſſels denote thoſe pieces of board that lie under the ends of the mantle-trees.

TASTE, *Savour*, in phyſiology, a peculiar ſenſation, excited by means of the organs of taſte, viz. the papillæ on the tongue.

The taſtes of bodies depend on a certain determinate magnitude of their particles, adapted to excite different ſenſations by means of the papillæ of the tongue.

Savours, which are the objects of the taſte in general, proceed chiefly from the ſaline parts, which are found in all matters, whether animal or vegetable, which we take either as food or phyſic. Theſe little angular pungent bodies are fitter than others to penetrate even to the immediate organ, and to make themſelves perceived there: we may judge of them by putting a grain of pure ſalt, of any kind whatever, upon the tongue, where it will make a very ſtrong impreſſion; and their analyſis diſcovers, that, of all mixed bodies, thoſe that affect the organ moſt, are ſuch as abound moſt in ſalts. See SALT.

The moſt ſimple ſavours, and upon which men are more generally agreed, are thoſe wherein the ſalts are the leaſt mitigated by the mixture of other matters. Every one knows what is meant by ſalt, ſour, ſweet, bitter, harſh, &c. Theſe different ſenſations are ſo remarkable that they are preſently diſtinguiſhed: they are, as it were, the baſis of all others, which become ſo much the more difficult to deſcribe and expreſs, the more they recede from their primary ſimplicity. The bitterneſs of coffee, for example, corrected by the ſweetneſs of ſugar, produces a mixed ſenſation; the juice of fruits, mingled with ſpirit of wine, takes a new taſte: the taſte of victuals changes almoſt entirely, and is diſguiſed a thouſand different ways, by that infinite number of preparations and mixtures, which the preſent age has rendered an important art.

TASTE is alſo uſed, in a figurative ſenſe, for the judgment and diſcernment of the mind.

We conſtantly hear talk of good and bad taſte, without well underſtanding the meaning of theſe terms: in effect, a good taſte ſeems, at bottom, to be little elſe but right reaſon, which we otherwiſe expreſs by the word judgment. Mad. Scudery and Mad. Dacier call good taſte a harmony between the mind and reaſon; and according as that harmony is more or leſs juſt, the perſon has more or leſs of this taſte.

TATIANITES, in church hiſtory, Chriſtian heretics in the ſecond century; ſo called from their leader Tatian, a diſciple of St. Juſtin.

This hereſiarch took from Valentinus the fable of the æons, and from Marcion the doctrine of two principles. But what particularly diſtinguiſhed his followers was, their condemning of marriage, and forbidding the eating of fleſh or drinking of wine.

TAT-TOO, q. d. a beat of a drum at night, to advertiſe the ſoldiers to retreat or repair to their quarters in their garriſon, or to their tents in a camp.

TAURUS, the bull, in zoology. See the article BULL.

TAURUS, in aſtronomy, one of the twelve ſigns of the zodiac, the ſecond in order, conſiſting of 44 ſtars, according to Ptolemy; of 41, according to Tycho; and of no leſs than 135, according to the Britannic catalogue.

TAUTOLOGY, in rhetoric, a needleſs repetition of the ſame thing in different words.

TAWING, the art of dreſſing ſkins in white, ſo as to be fit for divers manufactures, particularly gloves, &c.

All ſkins may be tawed; but thoſe chiefly uſed for this purpoſe are lambs, ſheep, kids, and goat-ſkins.

The method of tawing is this: Having cleared the ſkins of wool or hair, by means of lime, &c. as deſcribed under the article SHAMMY, they are laid in a large vat of wood or ſtone ſet on the ground full of water, in which quick-lime has been ſlaked, wherein they are allowed to lie a month or ſix weeks, according

ing as the weather is more or leſs hot, or as the ſkins are required to be more or leſs ſoft and pliant.

While they are in the vat, the water and lime is changed twice, and the ſkins are taken out and put in again every day; and when they are taken out for the laſt time, they are laid all night to ſoak in a running water, to get out the greateſt part of the lime; and in the morning are laid together by ſixes one upon another, upon the wooden leg, and are ſcraped ſtoutly one after another, to get the fleſh off from the fleſhy ſide, with a cutting two handled inſtrument called a knife; and then they cut off the legs, if they are not cut off before, and other ſuperfluous parts about the extremes. Then they are laid in a vat or pit with a little water, where they are fulled with wooden peſtles for the ſpace of a quarter of an hour, and then the vat is filled up with water, and they are rinſed in it.

In the next place, they are thrown on a clean pavement to drain, and afterwards caſt into a freſh pit of water, out of which they rinſe them well, and are laid again on the wooden leg, ſix at a time, with the hair-ſide outermoſt, over which they rub a kind of whetſtone very briſkly to ſoften and fit them to receive four or five more preparations, given them on the leg, both on the fleſh ſide and the hair-ſide, with the knife, after the manner above-mentioned.

After this they are put into a pit of water and wheaten-bran, and ſtirred about in it with wooden poles, till the bran is perceived to ſtick to them, and then they are left; as they riſe of themſelves to the top of the water by a kind of fermentation, they are plunged down again to the bottom, and at the ſame time fire is ſet to the liquor, which takes as eaſily as if it were brandy, but goes out the moment the ſkins are all covered.

They repeat this operation as often as the ſkins riſe above the water; and when they have done riſing they take them out, lay them on the wooden leg, the fleſhy ſide outwards, and paſs the knife over them to ſcrape off the bran.

Having thus cleared them of the bran, they lay the ſkins in a large baſket, and load them with huge ſtones to promote their draining: and when they have drained ſufficiently, they give them their feeding, which is performed after the manner following:

For one hundred of large ſheep ſkins, and for ſmaller in proportion, they take eight pounds of alum, and three of ſea-ſalt, and melt the whole with water in a veſſel over the fire, pouring the diſſolution out, while yet luke-warm, into a kind of trough, in which is twenty pounds of the fineſt wheat-flour, with the yolks of eight dozen of eggs; of all which is formed a kind of paſte, a little thicker than children's pap; which, when done, is put into another veſſel, to be uſed in the following manner:

They pour a quantity of hot water into the trough in which the paſte was prepared, mixing two ſpoonfuls of the paſte with it; to do which they uſe a wooden ſpoon, which contains juſt as much as is required for a dozen of ſkins; and, when the whole is well diluted, two dozen of the ſkins are plunged into it; but they take care that the water be not too hot, which would ſpoil the paſte and burn the ſkins.

After they have lain ſome time in the trough, they take them out, one after another, with the hand, and ſtretch them out; this they do twice; and after they have given them all their paſte, they put them into tubs, and there full them afreſh with wooden peſtles.

Then they put them into a vat, where they are ſuffered to lie for five or ſix days, or more; then they take them out in fair weather, and hang them out to dry on cords or racks, and the quicker they are dried the better; for if they be too long a-drying, the ſalt and alum within them are apt to make them riſe in a grain, which is an eſſential fault in this kind of dreſſing.

When the ſkins are dry, they are made up into bundles, and juſt dipped in fair water, and taken out and drained; and being thrown into an empty tub, and after having lain ſome time, are taken out and trampled under foot.

Then they draw them over a flat iron inſtrument, the top of which is round like a battledore, and the bottom fixed into a wooden block, to ſtretch and open them; and having been opened, they are hung in the air upon cords to dry: and being dry, they are opened a ſecond time, by paſſing them again over the ſame inſtrument. In the laſt place they are laid on a table, pulled out, and laid ſmooth, and are then fit for ſale.

After the ſame manner are dreſſed horſes, cows, calves-ſkins, &c. for the ſadlers, harneſs makers, &c. as alſo thoſe of dogs, wolves, bears, &c. except that in theſe they omit uſing the paſte, ſalt and alum-water being ſufficient.

TAX, a tribute rated upon every town, which formerly was wont to be paid annually into the King's-Exchequer, but now not without conſent of parliament; it differs from a ſubſidy in this, that it is always certain, as ſet down in the Exchequer-book, and in general levied of every town, and not particularly of every man, &c. The antient way of levying taxes was by tenths and fifteenths, afterwards by ſubſidies and royal aids, and at length by a pound rate; the former of theſe were all upon the perſon and perſonal eſtate, but the laſt upon lands and rents. In the late reigns, a land-tax has been annually granted of two, three, or four ſhillings in the pound, according to preſent exigencies, to be levied by commiſſioners on the ſeveral counties, cities, towns, &c. And in reſpect of this tax, the tenants, or occupiers, of the land are to be charged or aſſeſſed, and the ſame deducted out of the rent due to the landlords; and if any perſons refuſe to pay what they are rated, the collectors in every pariſh may levy it by diſtreſs and ſale of their goods; but in caſe they are over-rated, they may be relieved by an appeal to the commiſſioners, who have power to charge the overplus on others, as they ſhall ſee cauſe; or where there appears to be a deficiency, they may make a re-aſſeſſment, &c.

TAXIS, a term uſed by Vitruvius for what is now called ordonnance, being that which gives every part of a building its juſt dimenſions with reſpect to its uſes. See ORDONNANCE.

TAXUS, the yew-tree, in botany, a genus of plants, without any corolla. The calyx of the male flower is compoſed of three leaves: the ſtamina are numerous: the ſeed is ſingle, and ſurrounded by an undivided baccated calyx: the tree is very ſlow in growing, but there are many very large ones upon ſome barren cold ſoils in divers parts of England; the timber is much eſteemed for many uſes.

There is hardly any ſort of ever-green tree, which has been ſo generally cultivated in the Engliſh gardens as the yew, upon the account of its being ſo tonſible, as to be with eaſe reduced into any ſhape the owner pleaſed; and it may be too often ſeen, eſpecially in old gardens, what a wretched taſte of gardening prevailed formerly in England, from the monſtrous figures of beaſts, &c. we find theſe trees reduced into; but of late this taſte has been juſtly exploded by perſons of ſuperior judgment; for what could be more abſurd than the former methods of planting gardens? where, thoſe parts next the habitation were crouded by a large quantity of theſe and other ſorts of ever-green trees, all of which were clipped into ſome trite figure or other, which beſides the obſtructing the proſpect from the houſe, filled up the ground; ſo that little room was left for other ſhrubs and flowers. Beſides, it occaſioned an annual expence to render the trees diſagreeable; for there never was a perſon who had conſidered the beauty of a tree in its natural growth, with all its branches diffuſed on every ſide, but muſt acknowledge ſuch a tree infinitely more beautiful than any of thoſe ſhorn figures ſo much ſtudied by perſons of a grovelling imagination.

The only uſe this tree is fit for in gardens, is to form hedges for the defence of exotic plants; for which purpoſe, when it is neceſſary to have hedges, it is the moſt proper of any tree in being; the leaves being ſmall, the branches are produced very cloſely together; and if carefully ſhorn, they may be rendered ſo cloſe, as to break the winds better than any other ſort of fence whatever, becauſe they will not be reverberated, as againſt walls,

pales,

pales, and other close fences; therefore consequently, are much to be preferred for such purposes.

These trees may be easily propagated by sowing their berries in autumn, as soon as they are ripe, upon a bed of fresh undunged soil, covering them over about half an inch thick with the same earth.

In the spring the bed must be carefully cleared from weeds, and if the season prove dry, it will be proper to refresh the bed with water now and then, which will promote the growth of the seeds; many of which will come up the same spring, but others will remain in the ground until autumn or spring following; but where the seeds are preserved above ground till spring before they are sown, the plants never come up till the year after, so that by sowing the seeds as soon as they are ripe, there is often a whole year saved.

These plants, when they come up, should be constantly cleared from weeds, which, if permitted to grow amongst them, would cause their bottoms to be naked, and frequently destroy the plants when they continue long undisturbed.

In this bed the plants may remain two years; after which, in autumn, there should be a spot of fresh undunged soil prepared, into which they should be removed the beginning of October, planting them in beds about four or five feet wide, in rows about a foot asunder, and six inches distance from each other in the rows, observing to lay a little mulch upon the surface of the ground about their roots, as also to water them in dry weather until they have taken root; after which they will require no farther care, but to keep them clear from weeds in summer, and to train them according to the purpose for which they are designed.

In these beds they may remain two or three years, according as they have grown, when they should again be removed into a nursery, placing them in rows at three feet distance, and the plants eighteen inches asunder in the rows, observing to do it in autumn, as before directed, and continue to trim them in the summer, for what they are intended; after they have continued three or four years in this nursery, they may be transplanted where they are to remain, always observing to remove them in autumn where the ground is very dry; but on cold moist land it is better in the spring.

These trees are very slow in growing, but yet there are many very large trees upon some barren cold soils, in divers parts of England. The timber of these trees is greatly esteemed for many uses.

TEA, the leaf of an oriental shrub, called by Caspar Bauhine, Chaa herba in Japonia; by Breynius and Ray, the Sinensium sive t'sja Japonensibus; by Kæmpfer Thea frutex, &c. "The tea shrub, with leaves like those of the cherry-tree, flowers like those of the dog-rose, and a fruit composed of one, two, and, for the most part, three berries." This plant comes the nearest, in its general appearance, to the dog-rose, but is smaller, and without prickles. Dr. Cleyer, who lived some time in the East-Indies, sent several specimens to Simon Paulli in Denmark, and Dr. Mentzel in Berlin; of which figures may be seen in the Acta Haffnienfia, and the German Ephemerides.

Only one species of the tea-plant is as yet known; the differences in this commodity, as brought to us, proceeding from a difference in the climate, soil, age, method of collection and curation: some indeed mention a single and a double-flowered sort, but of this we have no certainty.

It is said by some to be a native of China only, by others both of China and Japan: others add a third country, namely, Siam; and suppose, not without probability, that the Japonic name Tsia is derived from thence. Thus much is certain, that at present it is regularly cultivated in different provinces of Japan and China, but does not in all prove of equal goodness: Fisien in Japan, and Nankin in China, produce the best.

The Chinese plant whole fields with tea; the Japanese only the borders of fields fronting the south. From six to a dozen of the berries are planted together, as they are very apt to fail; and covered with dung and earth: it is said, that they are three years in coming up, and that they are carefully covered in the winter with straw. After a certain number of years, which Kæmpfer limits between seven and ten, appear the admired leaves: after these have been gathered, the plant is either cut down, and new shoots expected from the root, or extirpated and renewed from seed. As the berries are extremely apt to spoil, insomuch as to require being planted quite fresh in their native climate, and as the shrub does not bear being removed entire, there are little hopes of our being ever able to introduce it into Europe; nor would it, probably, in these colder climates, prove equal in quality to the Chinese, since even in China and Japan it proves greatly different in different provinces.

If the winter does not prove very severe, the leaves come forth in February, and about the end of this month, or the beginning of next, the first collection is made. These early tender leaves are the true Imperial, called also improperly bloom tea; but they cannot be the sort to which the Dutch give that name, as being sold upon the spot, to the princes of the country, for vastly more than the common bloom-tea is sold for in Europe. About the end of March or the beginning of April, the second and most considerable crop is gathered: a large linen cloth is stretched over the bush, to defend from the sun not only the gatherers, but the leaves themselves, lest they should dry too fast, and lose their flavour. The leaves are picked one by one, so curiously, that the most industrious can scarcely collect four pounds in a day. They are commonly divided into four sortments; of which the smaller upper ones are the best, the larger lower ones the worst, and the intermediate of a middling goodness. The third collection is in the end of April or beginning of May; this likewise affords different sorts, which are those mostly brought into Europe: the very best sort which we meet with here, called imperial tea, is but the lower leaves of the second crop. About the end of May, all the leaves on the plant are gathered promiscuously, without sorting, and sold about the streets to the poorer people; these being the worst of all, and unfit for being cure[illegible]n the Chinese manner.

The Japonese, who swallow their tea in substance along with its infusion, dry it hastily in iron pans over the fire, and grind it into powder. The Chinese, on the other hand, are very curious of preserving the leaves entire; and roll them up that they may be less apt to break in carriage. So soon as gathered, they are brought into an apartment furnished with a number of little furnaces, each of which is covered with a smooth iron plate. The leaves are spread upon the plates, and kept rolling with the hands, in one direction, till they become moderately dry, and begin to curl up about the edges, when they are immediately swept off upon tables covered with smooth close mats, on which one person continues to roll them over and over, whilst another fans them, that they may cool hastily, and retain the curl. This process is repeated two or three times or oftener, according as the leaves are disposed to unbend upon standing. If exsiccated without artificial heat, or by a very soft one, they rarely take the curl, and never hold it.

Meister relates, that the leaves are put into a hot kettle just emptied of boiling water; and that in this they are kept closely covered till cold, and then committed to the hot plates: according to Lemery, they are held in the steam of water. But Kæmpfer mentions nothing of all this; and if any such thing is practised in regard to green-tea, it is to be supposed it is only for softening such of the leaves as have happened to grow too dry, and would break in the curling. Boerhaave pretends that the preparers employ green vitriol for improving the colour of the tea: this must certainly be false, because green vitriol, instead of heightening the green colour of tea, changes it to an inky blackness.

Thus much of the green-tea. With regard to bohea, we have not been able to meet with any satisfactory account, either in books, or from the communication of merchants, of both which great numbers have been consulted. Kæmpfer, and Dr. Cunningham, physician to the English settlement at Chusan, affirm, that it is the leaves of the first collection; but this must certainly be a mistake, as all the travellers agree that none of the first

crop

crop is brought into Europe, but that it is all reſerved for the princes of the land, and ſold at an immenſe price in China itſelf; whereas bohea comes over in large quantity, and is cheaper than the ſecond and third crops, if not than the fourth alſo. Poſſibly a particular kind of bohea is made from the firſt crop, for the uſe of the nobility; and our bohea, prepared in imitation of that, from the third and fourth collections, or perhaps from the earlier growths alſo in thoſe provinces where the plant does not come to ſuch perfection as to afford a good green-tea. The dark-browniſh colour, and roſe flavour obſerved in this kind of tea, I hold, with Sigeſbeck, to be artificial: the method of curation deſcribed by Meiſter, which certainly is in general not practiſed for the green, probably is for the bohea, which receives, perhaps, in the kettle, both its tincture and its flavour. This at leaſt is certain, that by a ſimilar proceſs good bohea may be made among ourſelves; a ſpecimen of which I have exhibited to a numerous audience. Some of the dealers in this commodity, in England, are not ignorant that certain European leaves, particularly thoſe of the dog-roſe and cherry tree, may be ſo coloured and prepared, as to paſs for good bohea. But I forbear to ſay any thing further of this manufacture, leſt a handle ſhould be given for new abuſes.

The Japan tea has been obſerved to be of a clearer green colour than the Chineſe, and to have its leaves ſmaller; but which of the two is the beſt has not hitherto been determined, ſome preferring the one, and others the other: this controverſy does but little concern us, the Chineſe being the only one brought into Europe. In China, tea is divided into a great number of different ſortments: there are ſixteen or twenty of the green leaves, from the difference in the collection only; and theſe are further multiplied, when the leaves are dry, by picking out ſuch as have miſcarried in the preparation. Among us, there are three principal kinds of green, and five of bohea: from what province they are brought, of what crop they are the produce, and to which of the Chineſe ſorts they belong, is unknown: they have all names, but theſe are merely arbitrary, and ſerve only for the conveniency of the dealer. The beſt of the green-teas is called bing, imperial and bloom-tea, Thea imperialis folio amplo laxo of Dale: the ſecond beſt Hyſſon, Thea viridis optima folio oblongo Dal: the third or worſt, Singlo, Thea viridis folio minore Dal. Of bohea (Thea fuſca folio ad nigredinem vergente) the ſorts are ordinary, pecco, congo, camho, and ſouchong; of which the firſt is the worſt, and the laſt the beſt.

The Chineſe are extremely curious and cleanly in every branch of the tea manufacture. They gather the leaves, as I have been well aſſured, with gloves made of a thin kind of leather. The workmen employed in the curation are reſtrained, for a fortnight before, from flatulent foods, and whatever might endanger communicating any ill flavour. The tea, when cured, is packed up in large veſſels made of a mixture of lead and tin called calin, or in wooden cheſts lined with this compoſition, or in canniſters of tinned plates ſoldered with the ſame, ſo tight, that they may be kept occaſionally under water.

As ſoon as tea became known in Europe, with its uſes among the Chineſe, all the European nations thirſted after it. Its great price at that time confined it to the rich, whence the learned were induced to examine the European plants, with a view to diſcover a cheap ſuccedaneum to it. The moſt celebrated of our ſubſtitutes is veronica, on which Hoffmann and Joh. Francus have written particular diſſertations. The leaves of the red whortle-berry and roſe-buſh are at preſent in greater eſteem, and come nearer to the taſte of the true tea than any of the other plants that have been employed for this purpoſe, as betony, nettles, agrimony, coltsfoot, eye-bright, ſtrawberry, ſcabious, cow-ſlips, golden-rod, cherry-tree, peach-tree, wall-rue, ſharp-leaved plantane, ſanicle, liverwort, lungwort, brankurſine, balm, ſage, roſemary, &c. It muſt be acknowledged that theſe plants are poſſeſſed of conſiderable virtues, greater in particular caſes, than any that tea can pretend to; yet ſtill they want the chief excellence of tea, that of being a diluent almoſt univerſally acceptable.

Some pretended to have diſcovered the oriental tea itſelf in Europe or America. The firſt of theſe was Simon Paulli, who obſtinately maintained that tea was no other than the chamæleagnus or Dutch myrtle, but was refuted by ſeveral botaniſts in Europe, and by the ſpecimens ſent by Dr. Cleyer. The next was father Labat, who in his Voyages to America relates, that in Martinico there grows a plant called wild tea, agreeing in all reſpects with the China, ſort except that it has not ſo much of the violet ſmell; for in every other reſpect, he ſays, it is aſſuredly the ſame thing. He adds further, that he had procured tea-ſeeds from the Eaſt Indies, and raiſed the plant in America. That he was miſtaken here, as he often was in botanic matters, is obvious from his own account: his ſeeds were ſmaller than poppy ſeeds, whilſt thoſe of tea are a kind of large nut or berry: his flowers had each but four ſtamina, whilſt in one of the tea-flowers Kæmpfer counted two hundred and thirty. The plant is no other than that called in England Weſt-In-India tea, found in great plenty by Sir Hans Sloane about Spaniſh-town in Jamaica. About twenty years ago there was another pretended diſcovery of tea in the Imperial dominions; but this like the others, when examined by a botaniſt, was found to be a quite different plant; and the Jeſuits have at times made great noiſe with this plant, under the name of Roman tea.

The oriental tea, as we have already ſeen, is of two kinds, green and bohea. The firſt is not only externally green, but likewiſe imparts the ſame colour to water; the freſher the tea, the greener is the infuſion; its prevailing ſmell is generally that of violets or new hay: bohea on the other hand is externally of a blackiſh brown colour, gives a browniſh tincture to water, and ſmells of roſes. Green tea ſhould be choſen freſh, of a fine colour, not inclining to a yellowiſh or browniſh, which are marks of too great age, well rolled, conſiſting of entire leaves, thoroughly dry, ſo as to be friable betwixt the fingers, of a bitteriſh ſubaſtringent not ungrateful taſte, and a pleaſant light ſmell. When either the violet or hay-ſmell are very ſtrong, we may ſuſpect them to be introduced by art, the leaves having but little from nature: the firſt is communicated by putting into the canniſters a little Florence orris root; the latter, by placing the tea for a few days, wrapt in papers, among new made hay; this leaf being remarkably ſuſceptible of any kind of flavour. There are other abuſes common among the Dutch: as mixing, with the tea, leaves of European growth and manufacture; and introducing into the old decayed green, a freſh tincture.

The preparation and uſe of tea as a dietetic liquor, are in general well known. With regard to its medical effects, ſome have exceſſively extolled, and others as extravagantly condemned it. Tea is in many caſes a very uſeful liquor; a grateful diluent in health, and a ſalutary drink in ſickneſs: it attenuates viſcid juices, promotes the natural excretions, excites appetite, and proves ſerviceable particularly in fevers, in immoderate ſleepineſs, after a debauch, and in head-achs ariſing from that cauſe; no other plant is known, whoſe infuſion paſſes off more freely by the emunctories of the body, or more ſpeedily excites the ſpirits. It is not however without its inconveniencies: in habitual colics it is found to do harm, and in urinary obſtructions it ſhould be ſparingly drank: its immoderate uſe is productive of cacochymic, cachectic, chlorotic diſorders, and weakens the tone of the ſtomach and nervous ſyſtem. It is ſaid, when new, to be narcotic, and to diſorder the ſenſes; but to loſe this quality, in great part by the exſiccation, and totally by being kept for a year: in the tea countries, it is a principal caution to abſtain from it till this period, but in Europe there is no danger of its being uſed too new.

Some aſcribe the good or ill effects obſerved from the uſe of tea wholly to the leaves, and others to the water. The ſimple element has undoubtedly a conſiderable ſhare in both: it is not, as ſome have ſuppoſed, the virtue of the tea-leaf, but the warm aqueous liquor, with the climate and diet, that preſerves the inhabitants of China and Japan from calculous and gouty diſorders. But on the other hand, that the herb communicates alſo ſome peculiar qualities to the liquor is equally certain: in

weak ſtomachs, a moderately ſtrong infuſion of tea, without ſugar, generally provokes a puke: an infuſion of two or three drams of bohea in two ounces of water, is a common emetic among the Chineſe; and the green is ſometimes employed in the like intention among ourſelves.

Both the green and bohea teas have an agreeable ſmell, a lightly bitteriſh ſubaſtringent taſte, as hath been already obſerved: with ſolution of chalybeate vitriol, they ſtrike an inky blackneſs. They give out their ſmell and taſte both to watery and to ſpirituous menſtrua: to water, the green ſorts communicate their own green tincture, and the bohea their brown: to rectified ſpirit they both impart a fine deep green. On gently drawing off the menſtrua from the filtered tinctures, the water is found to elevate nearly all the peculiar flavour of the tea, while rectified ſpirit brings over little or nothing, leaving the ſmell as well as the taſte concentrated in the extract: both extracts are very conſiderably aſtringent, and not a little ungrateful: the ſpirituous moſt ſo.

TEARS, *Lachrymæ*, a watery humour iſſuing out at the corner of the eye by the compreſſion of the muſcles, ſerving to moiſten the cornea, to expreſs our grief, and even to alleviate it.

TEASEL, or TEAZEL, *carduus fullonum*, in botany. See the article DIPSACUS.

This plant is much uſed by the fullers, cloth-workers, and ſtocking-weavers, to card or draw out the wool or nap from the thread or ground of ſeveral kinds of cloth, ſtuffs, ſtockings, &c. in order to render them cloſer and warmer.

This plant is propagated by ſowing the ſeeds in March, upon a ſoil that has been well prepared. About one peck of ſeed will ſow an acre; for the plants ſhould have room to grow, otherwiſe the heads will not be ſo large, nor in ſo great quantity. When the plants are come up, they muſt be hoed in the ſame manner as is practiſed for turnips, cutting down all the weeds, and ſingling out the plants to about eight inches diſtance; and as the plants advance, and the weeds begin to grow again, they muſt be hoed a ſecond time, cutting out the plants to a wider diſtance; for they ſhould be, at laſt, left at leaſt a foot aſunder: and ſhould be kept clear from weeds, eſpecially the firſt ſummer; for when the plants have ſpread ſo as to cover the ground, the weeds will not ſo readily grow between them. The ſecond year after ſowing, the plants will ſhoot up heads, which will be fit to cut about the beginning of Auguſt; at which time they ſhould be cut, and tied up in bunches, ſetting them in the ſun, if the weather be fair; but if not, they muſt be ſet in rooms to dry them. The common produce is about an hundred and ſixty bundles or ſtaves upon an acre, which they ſell for one ſhilling a ſtave. Some people ſow caraway and other ſeeds amongſt their teaſels; but this is not a good method, for the one ſpoils the other; nor can the weeds be ſo well cleaned away from the teaſels.

TEBETH, the tenth month of the Jewiſh eccleſiaſtical year, and fourth of the civil. It anſwers to our month of December.

TECHNICAL expreſſes ſomewhat relating to arts or ſciences: in this ſenſe we ſay technical terms. It is alſo particularly applied to a kind of verſes wherein are contained the rules or precepts of any art, thus digeſted to help the memory to retain them; an example of which may be ſeen in the article MEMORY.

TE DEUM, the name of a celebrated hymn, uſed in the Chriſtian church, and ſo called becauſe it begins with theſe words, *Te Deum Laudamus*; We praiſe thee, O God. It is ſung in the Romiſh church, with great pomp and ſolemnity, upon the gaining of a victory, or other happy event.

TEETH, *Dentes*. See the article TOOTH.

TEGUMENT, or INTEGUMENT, any thing that ſurrounds or covers another. The common teguments of the human body are the cutis, cuticle, and fat.

TEINTS, and SEMI-TEINTS, in painting, denotes the ſeveral colours uſed in a picture, conſidered as more or leſs high, bright, deep, thin or weakened, and diminiſhed, &c. to give the proper relievo, ſoftneſs, or diſtance, &c. of the ſeveral objects.

TELAMON, or ALAS, a name given to thoſe figures or half figures of men ſo commonly uſed inſtead of columns or pilaſters, to ſupport any member in architecture, as a balcony, or the like.

TELESCOPE, an optical inſtrument conſiſting of ſeveral lenſes, by means of which remote objects are ſo magnified as to appear nigh at hand.

That the teleſcope is of a modern invention is moſt certain; neither does it appear that microſcopes, or optic glaſſes of any kind, were known to the ancients.

It is contended, that Alexander de Spina, a native of Piſa, was the firſt that made the uſe of glaſſes known to the world; but our countryman, friar Bacon, who died twenty-one years before him, was, in all probability, acquainted with them firſt; for he wrote a book of perſpective, in which he plainly ſhews that he did not only underſtand the nature of convex and concave glaſſes, but the uſe of them when combined in teleſcopes; though he no where, in that treatiſe, diſcovers the manner in which they are to be put together. The teleſcope, with the concave eye glaſs, was firſt invented by a mechanic of Middleburgh in Zealand, called Z. Johannides, about the year 1590, though J Lipperhoy, another Dutchman, is candidate for the ſame diſcovery; from whence this ſort of teleſcope is called tubus Batavus.

Franciſcus Fontana, a Neapolitan, contends, that he was the firſt contriver of the teleſcope compoſed of two convex glaſſes, which is now the common aſtronomical teleſcope; and Rheita pretends to be the firſt that rendered that teleſcope fit for terreſtrial uſes, by adding two eye-glaſſes to it.

The teleſcope is of two ſorts, viz. dioptric, or refracting; or cata-dioptric, by reflection and refraction conjointly.

Dioptric or Refracting TELESCOPE conſiſts of an object-glaſs *x z* (plate CXXVI. *fig.* 3.) by which the image *f d* of an object O B, at a diſtance, is formed in the focus *e* of the ſaid glaſs, and in an inverted poſition. This image may be viewed by a ſingle lens, *a b*, placed at its focal diſtance, as is uſually done for viewing the heavenly bodies, becauſe in them we do not regard the poſition: but for viewing objects near us, whoſe image we would have erect, we muſt, for that purpoſe, add a ſecond lens *p q*, at double its focal diſtance from the other, that the rays which come from *a b* may croſs each other in the focus *o*, in order to erect the image *g n*, which it will form in its own focus *m*, becauſe the rays come parallel from the firſt lens *a b*. Laſtly, a third lens *i c* is added, to view the ſecondary image *g n*. Theſe three lenſes, or eye-glaſſes, are uſually of the ſame ſize and focal length; and the power of magnifying is always as the focal length of the object-glaſs *e w* divided by the focal length of the eye-glaſs *l m* or *h e*: for inſtance, ſuppoſe *e w* = 10 feet or 120 inches, and *h e* or *l m* = 3 inches; then will the object appear to the eye, through ſuch a teleſcope, 40 times bigger than to the naked eye; and its ſurface will be magnified 1600 times, and its bulk or ſolidity 64000 times.

If inſtead of a convex eye-glaſs we ſhould uſe a concave one of the ſame focal length, it would repreſent the object erect, equally magnified, and more diſtinct and bright; but the diſadvantage of this glaſs is, that it admits but of a ſmall area, or field of view, and, therefore, not to be uſed when we would ſee much of an object, or take in a great ſcope; but it is uſed to great advantage in viewing the planets and their ſatellites, Saturn's ring, Jupiter's belts, &c.

The manifying power of a refracting teleſcope is thus eſtimated. Let A B (*fig.* 4.) be the object-glaſs, and C D the eye-glaſs; and let H F I and G F M be two rays coming from the extreme parts of a diſtant object, and croſſing each other in the center F of the glaſs A B. Then is the angle G F H = I F M, that under which the object appears to the naked eye; but I E M = C K D is that under which the image appears as magnified by the eye-glaſs C D. But the angle I E M is to the angle I F M, as L F to L E, or as the focal diſtance of the object-glaſs to the focal diſtance of the eye-glaſs; and in that proportion is the object magnified.

There is a defect in all teleſcopes of this kind, not to be remedied by any means whatever, which was thought only

only to arise from hence, viz. that spherical glasses do not collect rays to one and the same point; but it was happily discovered by Sir Isaac Newton, that the imperfection of this sort of telescope, so far as it arises from the spherical form of the glasses, bears almost no proportion to that which is owing to the different refrangibility of light. This diversity in the refraction of the rays is about a twenty-eighth part of the whole, so that the object-glass of a telescope cannot collect the rays, which flow from any one point in the object, into a less room than the circular space, whose diameter is about the fifty-sixth part of the breadth of the glass. Therefore, since each point of the object will be represented in so large a space, and the centers of those spaces will be contiguous, because the points in the objects the rays flow from are so, it is evident that the image of an object made by such a glass must be a most confused representation, though it does not appear so when viewed through an eye-glass that magnifies in a moderate degree; consequently, the degree of magnifying in an eye-glass must not be too great with respect to that of the object-glass, lest the confusion become sensible. Notwithstanding however this imperfection, a dioptrical telescope may be made to magnify in any given degree, provided it be of sufficient length; for the greater the focal distance of the object-glass is, the less may be the proportion which the focal distance of the eye-glass may bear to that of the object-glass, without rendering the image obscure. Thus an object-glass, whose focal distance is about four feet, will admit of an eye-glass whose focal distance shall be little more than one inch, and, consequently, will magnify almost forty-eight times: but an object-glass of forty feet focus, will admit of an eye-glass of only four inch focus, and will therefore, magnify 120 times; and an object-glass of an hundred feet focus, will admit of an eye-glass of little more than six inch focus, and will therefore magnify almost 200 times.

The reason of this disproportion, in their several degrees of magnifying, is to be explained in the following manner: since the diameters of the spaces, into which rays flowing from the several points of an object are collected, are as the breadth of the object-glass, it is evident, that the degree of confusedness in the image is as the breadth of the glass, for the degree of confusedness will only be as the diameters or breadths of those spaces, and not as the spaces themselves. Now the focal length of the eye-glass, that is, its power of magnifying, must be as that degree; for, if it exceeds it, it will render the confusedness sensible; and, therefore, it must be as the breadth or diameter of the object-glass. The diameter of the object-glass, which is as the square root of its aperture or magnitude, must be as the square root of the power of magnifying in the telescope; for, unless the aperture itself be as the power of magnifying, the image will want light: the square root of the power of magnifying, will be as the square root of the focal distance of the object-glass; and, therefore, the focal distance of the eye-glass must be only as the square root of that of the object-glass. So that in making use of an object-glass of a longer focus, suppose than one that is given, you are not obliged to apply an eye-glass of a proportionably longer focus than what would suit the given object-glass, but such a one only whose focal distance shall be to the focal distance of that which will suit the given object glass, as the square root of the focal length of the object glass you make use of, is to the square root of the focal length of the given one. And this is the reason that longer telescopes are capable of magnifying, in a greater degree than shorter ones, without rendering the object confused or coloured.

Cata-dioptric, or *Reflecting* TELESCOPE, is the most noble and useful of all others; the mechanism of which is as follows:

A B E H, *fig.* 5. is the large tube, or body of the instrument, in which B E is a large reflecting mirrour, with a hole in the middle C D. This mirrour receives the rays, *a*, *c*, *b*, *d*, coming from the object at a distance, and reflects them converging to its focus *e*, where they cross each other, and form the inverted image I M; *x y* is a small concave mirrour, whose focus is at *f*, at a small distance from the image. By this means the rays coming from the image are reflected back through the central hole C D of the large mirrour, where they fall on the plano-convex lens W X, and are by it converged to a focus, and there form a second image R S, very large and erect, which is viewed by a meniscus eye-glass Y Z, by the eye at P, through a very small hole in the end of the eye-piece Y C D Z. If the first lens W X were taken away, the image would be formed somewhat larger at M I; but the area or scope would be less, and therefore the view not so pleasant. At T V is placed a circular piece of brass, with a hole of a proper size to circumscribe the image, and cut off all superfluous or extraneous rays, that so the object may appear as distinct as possible.

As the image is formed by reflection, the rays of every sort will be united nearly in one point, and will therefore admit of an eye-glass Y Z of a deep charge, or small focal distance; and so the power of magnifying will be proportionally increased.

The magnifying power of a reflecting telescope is thus computed. The parallel rays K B (*fig.* 6.) and L E are reflected by the large object speculum A F to its focus *a*, where the image I M is formed; which image is defined by two other rays N Q, P Q, coming from the extreme parts of the object at a remote distance, and meeting in the center of the large speculum at Q. Now, if *f* be the focus of the small mirrour G H, supposing the image were formed in the said focus *f*, that is, that both the foci *a* and *f* were coincident, then the rays proceeding from the image I M will proceed parallel after reflection, and produce distinct vision of the image, which will then subtend an angle I O M at the center O of the speculum G H, which is to the angle I Q M, under which the object appears to the naked eye, as *a* Q to *a* O or *f* O. So that the magnifying power would in this case be as $\frac{a\,Q}{f\,O}$.

But, to increase this magnifying power, the image I M is not placed in the focus of the small speculum; but at a small distance beyond it; by which means the rays coming from the image to the speculum G H will be reflected converging to a distant focus R, where a secondary large image *I M* is formed from the first image I M; which image I M is seen under the same angle *I O M* with the former from the center of the speculum G H: but from the center of the eye-glass T V it is seen under the large angle *I S M*. But the angle *I S M* is to the angle *I O M* as O R to S R; wherefore the second ratio, or part of the magnifying power, is that of $\frac{O\,R}{S\,R}$.

Consequently the whole magnifying power of the telescope is $\frac{a\,Q}{a\,O} \times \frac{O\,R}{S\,R}$, because in this case *f* O becomes *a* O. Or in other words, the angle N Q P, under which the object appears to the naked eye, is to the angle *I S M*, under which the large magnified secondary image *I M* appears to the eye through the eye-glass, as $\frac{a\,Q \times O\,R}{a\,O \times S\,R}$. Such is the theory of the telescope first contrived by Dr. J. Gregory, and therefore called the Gregorian telescope; but it received its last improvement from the late Mr. Hadley, and is now in common use.

A small alteration was made in the structure of this telescope by Mr. Cassegrain, viz. in using a convex speculum *G H* (*fig.* 7.) instead of the concave one G H. Now if they are equally spherical, that is, if they are segments of the same sphere, then will *f* be also the vertual focus of the convex G H; and if all other things remain the same, the first image I M will be virtually the same as before, and the last image *I M* will be really the same: so that the magnifying power of this form of the telescope is $\frac{a\,Q}{a\,O} \times \frac{O\,R}{S\,R}$ which is equal to that of Gregory's form.

Sir Isaac Newton orderd this telescope to be made in a different form or manner, as follows: A B C D (*fig.* 8.) was a large octogonal tube or case; E F a large polished speculum, whose focus is at *o*; G H a plane speculum truly concentrated, and fixed at half a right angle with the

the axis of the large one. Then parallel rays *a* E, *b* F, incident on the large ſpeculum E F, inſtead of being reflected to the focus *o*, were intercepted by the ſmall plane ſpeculum G H, and by it reflected towards a hole *c d* in the ſide of the tube, croſſing each other in the point O, which is now the true focal point; and from thence they proceed to an eye-glaſs *e f* placed in that hole, whoſe focal diſtance is very ſmall, and therefore the power of magnifying may be very great in this form of the teleſcope; becauſe the image I M is made by one reflection; for that of the plane ſpeculum only alters the courſe of the rays, and adds nothing to the confuſion of the image, and will, for that reaſon, bear being viewed by a glaſs of a very deep charge, in compariſon of an image formed by differently refrangible rays.

This teleſcope is a very good one, as to its effect or performance, but it is not ſo commodious for common uſe as thoſe of the Gregorian form, and is therefore now pretty much laid aſide. They who would ſee a larger account thereof, may conſult Sir Iſaac Newton's Optics, and ſeveral Philoſophical Tranſactions, where he deſcribes it at large, and the reaſons which induced him to make choice of this ſtructure rather than that of Dr. Gregory: or ſee a compendious account of the whole in the laſt edition of Dr. Gregory's Elements of Optics.

Solar TELESCOPE. This inſtrument is applied to uſe in the following manner: A B (*fig.* 9.) repreſents a part of the window ſhutter of a darkened room, C D the frame, which, by means of a ſcrew, contains the ſcioptric ball E F, placed in a hole of the ſaid ſhutter adapted to its ſize. This ball is perforated with a hole *a b c d* through the middle; on the ſide *b c* is ſcrewed into the ſaid hole a piece of wood, and in that is ſcrewed the end of a common refracting teleſcope G H, I K, with its object-glaſs G H, and one eye-glaſs at I K; and the tube is drawn out to ſuch a length, as that the focus of each glaſs may fall near the ſame point.

This being done, the teleſcope and ball are moved about in ſuch a manner as to receive the ſun-beams perpendicularly on the lens G H, through the cylindric hole of the ball; by this glaſs they will be collected all in one circular ſpot *m*, which is the image of the ſun. The lens I K is to be moved nearer to or farther from the ſaid image *m*, as the diſtance at which the ſecondary image of the ſun is to be formed requires, which is done by ſliding the tube I K L M backwards and forwards in the tube L M N O. Then of the firſt image of the ſun *m* will be formed a ſecond image P Q, very large, luminous, and diſtinct.

In this manner the ſun's face is viewed at any time, without offence to weak eyes; and whatever changes happen therein may be duly obſerved. The ſpots, which make ſo rare an appearance to the naked eye, or through a ſmall teleſcope in the common way, are here all of them conſpicuous, and eaſy to be obſerved under all their circumſtances of beginning to appear, increaſe, diviſion of one into many, the uniting of many into one, the magnitude, decreaſe, abolition, diſappearance behind the ſun's diſk, &c.

By the ſolar teleſcope, we alſo view an eclipſe of the ſun to the beſt advantage, as having it in our power by this means to repreſent the ſun's face or diſk as large as we pleaſe, and conſequently the eclipſe proportionably conſpicuous. Alſo the circle of the ſun's diſk may be ſo divided by lines and circles drawn thereon, that the quantity of the eclipſe eſtimated in digits, may this way be moſt exactly determined; alſo the moments of the beginning, middle, and end thereof, for finding the longitude of the place: with ſeveral other things relating thereto.

The tranſits of Mercury and Venus over the face of the ſun, are exhibited moſt delightfully by this inſtrument. They will here appear truly round, well defined, and very black; their comparative diameters to that of the ſun may this way be obſerved, the direction of their motion, the times of their ingreſs and egreſs, with other particulars for determining the parallax and diſtance of the ſun, more nicely than has hitherto been done.

By the ſolar teleſcope, you ſee the clouds moſt beautifully paſs before the face of the ſun, exhibiting a curious ſpectacle according to their various degrees of rarity and denſity. But the beautiful colours of the clouds ſurrounding the ſun, and refracting his rays, are beſt ſeen in the picture made by the camera-glaſs.

The fine azure of the ſky, the intenſely ſtrong and various dyes of the margins of clouds, the halo's and corona's, are this way inimitably expreſſed. And ſince the priſmatic colours of clouds, ſo variouſly compounded here, make ſo noble and delightful a phænomenon, it is ſurpriſing that no more regard is had thereto by painters, whoſe clouds, though near the ſun, are ſeldom or never ſeen tinged or variegated with thoſe natural tints and colours.

Aerial TELESCOPE, is a dioptric teleſcope, uſed without a tube, in a dark night; for the uſe of the tube is not only to direct the glaſſes, but alſo to make the place dark where the images of objects are formed.

Huygenius contrived a teleſcope of this kind for viewing the celeſtial bodies by fixing the object-glaſs on the top of a long upright pole, and directing its axis towards any object by means of a ſilk line coming from the object-glaſs to the eye-glaſs below.

We ſhall here give the deſcription of one of theſe teleſcopes. On the top of a long pole, or maſt, *a b* (plate CXXVI. *fig.* 10.) is fixed a board moveable up and down in the channel *c d*; *e* is a perpendicular arm fixed to it, and *f f* is a tranſverſe board that ſupports the object-glaſs incloſed in the tube *i*, which is raiſed or lowered by means of the ſilk thread *r l*; *g g* is an endleſs rope, with a weight, *h*, whereby the apparatus of the object-glaſs is counterpoiſed; *k l* is a ſtick faſtened to the tube *i*; *m* the ball and ſocket, by means of which the object-glaſs is moveable every way; and to keep it ſteady there is added a weight *n* ſuſpended by a wire; *l* is a ſhort wire, to which the thread *r l* is tied; *o* is the tube which holds the eye-glaſs; *q* the ſtick fixed to this tube, *s* a leaden bullet, and *t* a ſpool to wind the thread on; *u* is pins for the thread to paſs through; *x* the reſt for the obſerver to lean upon; and *y* the lantern. In this manner, teleſcopes have been conſtructed 123 feet long.

There are ſeveral ways of preparing a pole of a proper height, which every workman can readily employ. But as unexperienced perſons cannot eaſily find out and follow an object with this ſort of teleſcope, we ſhall ſhew how this may be done by means of a ſmall machine placed upon a reſt *a a* (*fig.* 11.) and a variable rhombus, made of braſs plates *b b*, two of whoſe ſides are produced, till they equal the ſides of the rhombus, which is fixed at *g g* to the reſt. From the upper angle of the rhombus, there projects a ſmall axis about half an inch: on this axis is fixed the plate *e*, which upon a very ſmall axis ſupports the ſtick and tube of the eye-glaſs, and the whole is counterpoiſed upon the axis *f* by proper weights *h*, *h*. Things being thus ordered, to whatever place the obſerver ſhall move the object glaſs, by the handle *d*, there it will remain at reſt.

And for managing the object-glaſs, M. de la Hire contrived the machine repreſented *fig.* 12. where E F is an oblong piece of wood, of a convenient magnitude, to the ends of which are fixed two cylindrical ſtaves G H, I K, to ſerve as an axis; then a hole is bored in a line with this axis, for the wooden axis S L M to paſs through, with two nuts S, M. To the upper end, S, is fixed a ſquare board A C, with a circular pole in it to receive the object-glaſs; and to the bottom corners of this board are fixed two wooden rulers, which meet at N, where there is a pin, R; to which the ſilk thread for moving the object-glaſs is tied, as much below the line C D as the axis G K, which lies upon two tenter-hooks O, P. To keep off the dew from the object-glaſs, the ſame gentleman orders it to be included in a paſte-board tube, made of ſpongy-paper, to ſuck up the humidity of the air: and to find an object more readily, he preſcribes a broad annulus of white paſteboard to be put over the tube that carries the eye-glaſs; upon which the image of the object being painted, an aſſiſtant, that ſees it, may direct the tube of the eye-glaſs into its place: or, that the obſerver himſelf may ſee it, he would have it received upon a ring of tranſparent oiled paper, paſted upon a circular frame inſtead of paſteboard.

Tapestry Loom for the high Warp or that in a Perpendicular Situation.

Fig. 1. Tapestry Weaving

Tapestry Loom for the low Warp, or that in an Horizontal Situation.

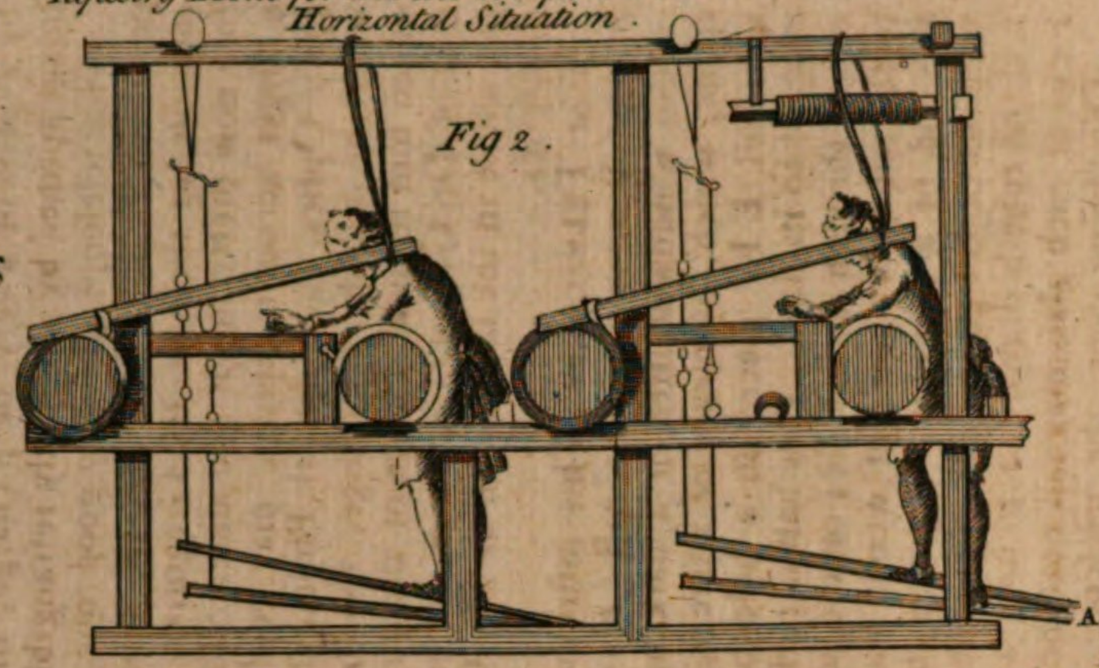


Fig 2.

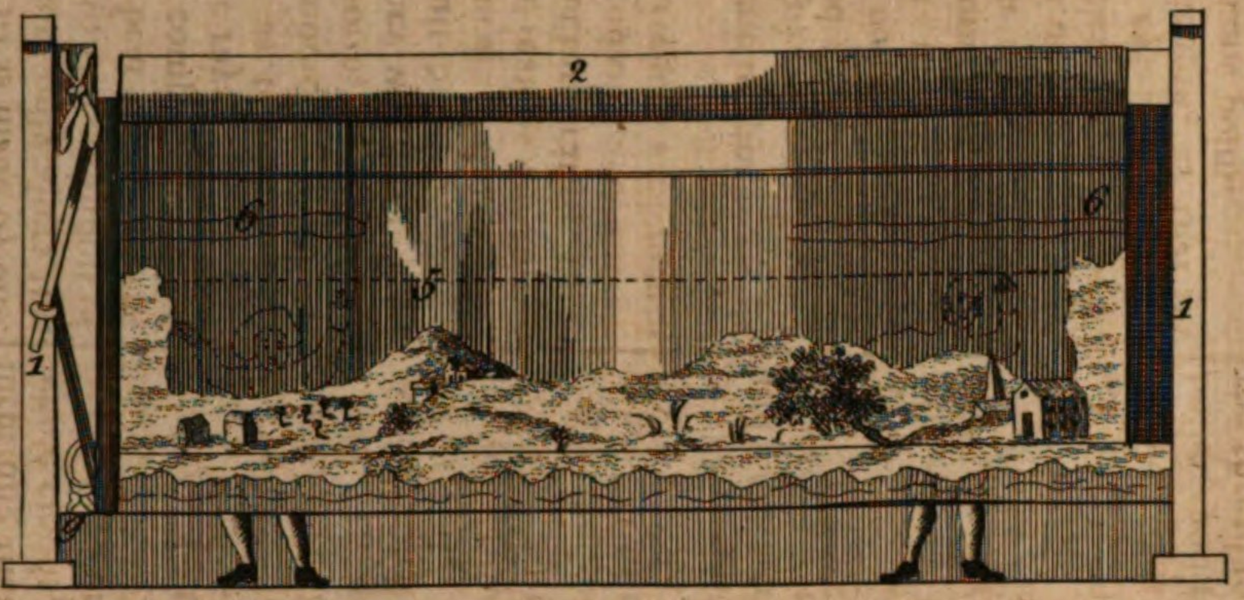


Fig. 8.

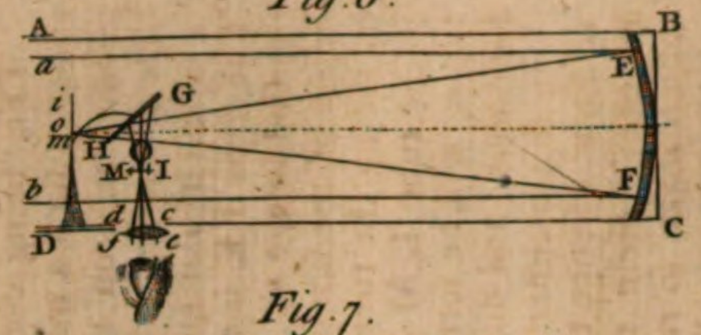


Fig. 7.

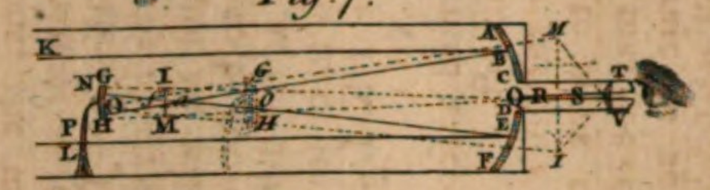
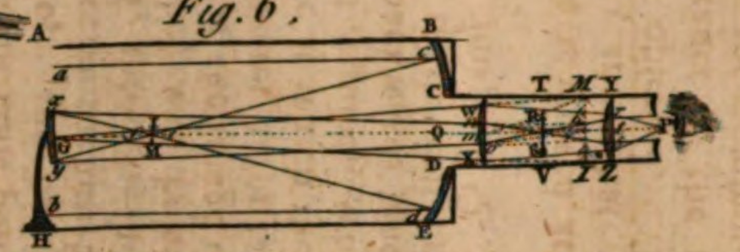
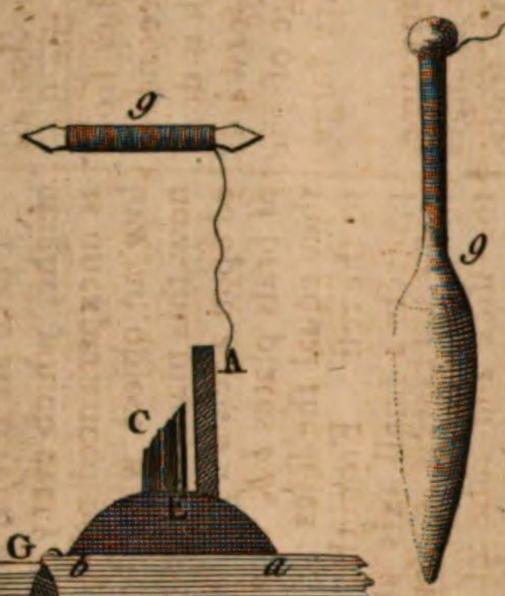


Fig. 6.





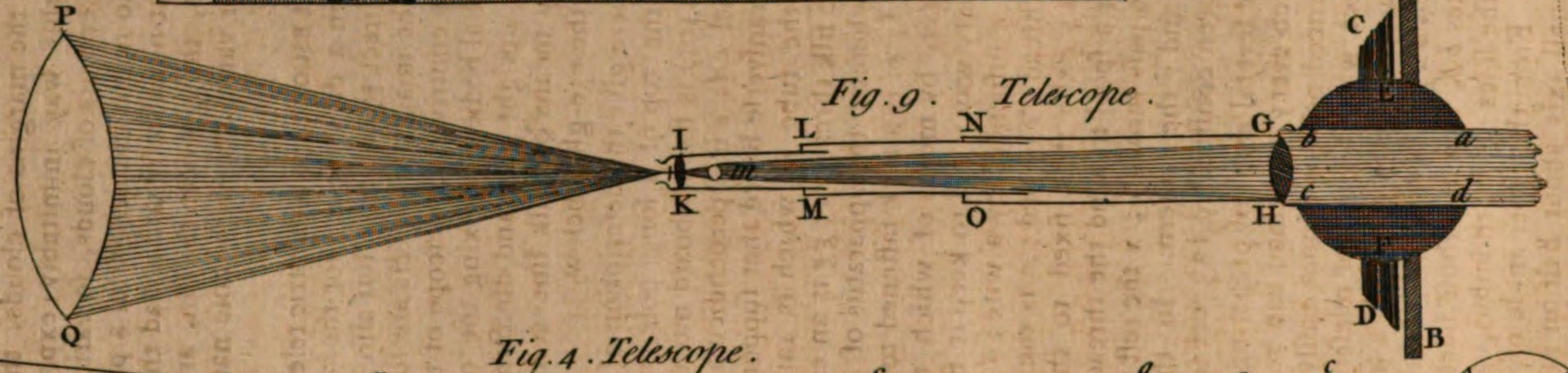
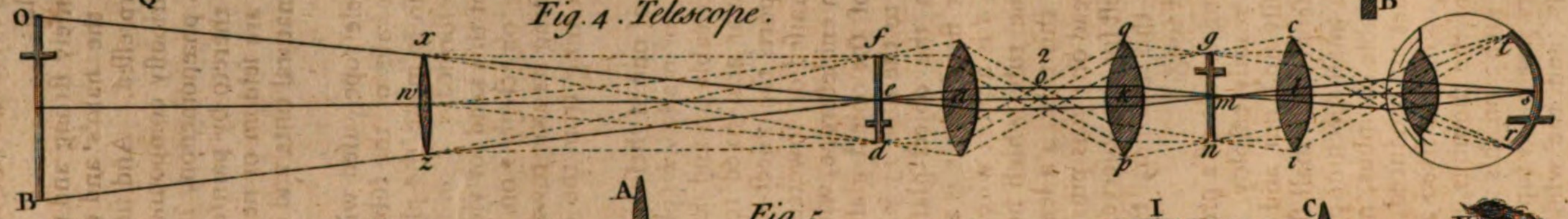


Fig. 9. Telescope.



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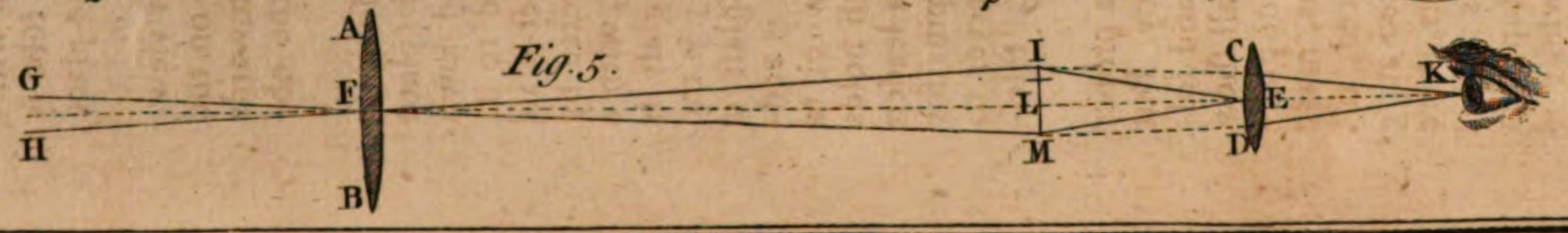
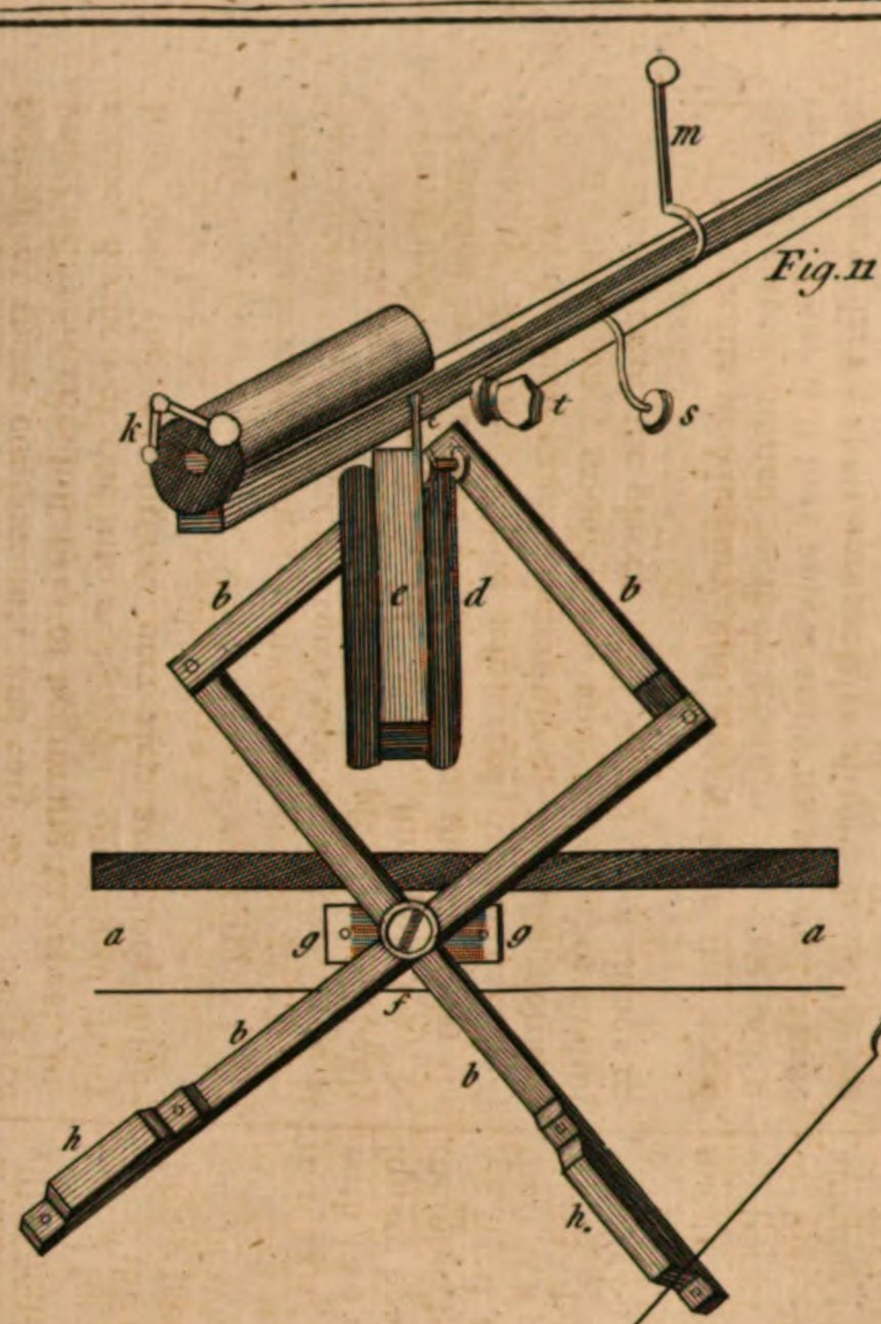


Fig. 5.

Fig. 11. Telescope.



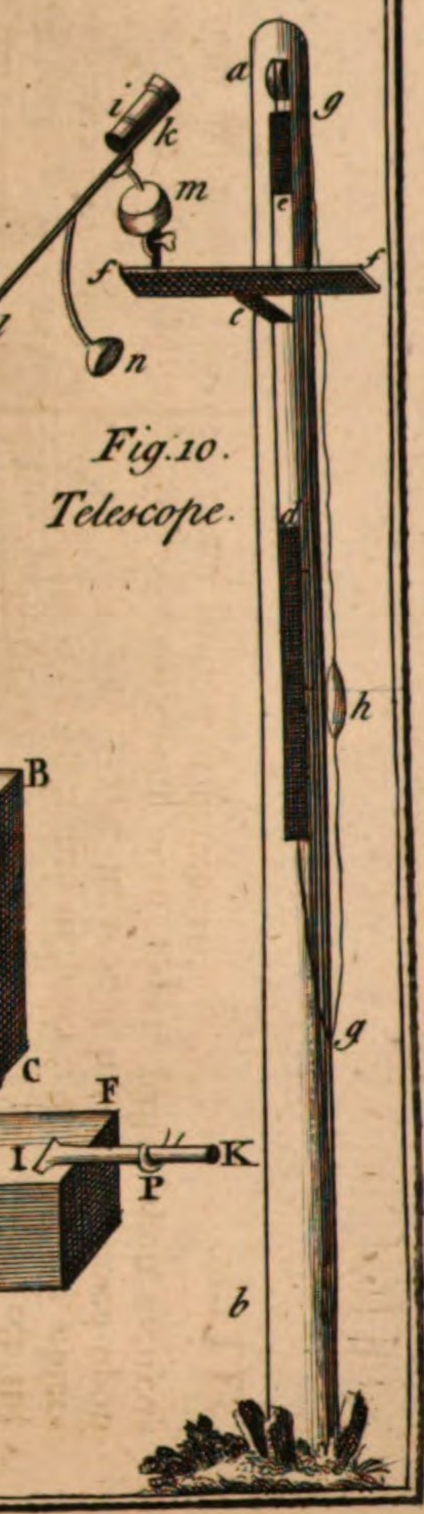
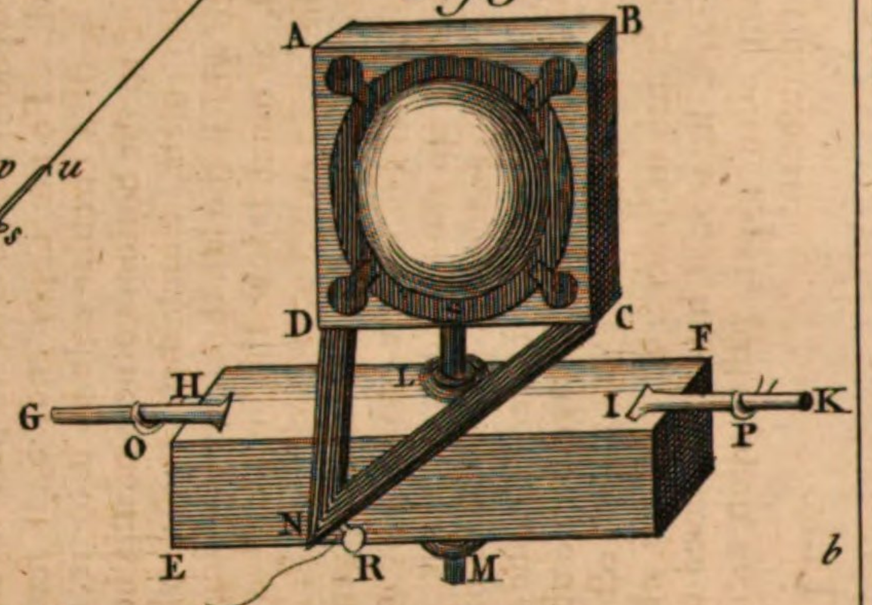


Fig. 10. Telescope.

Fig. 3.



TELESCOPICAL STARS, ſuch as are not viſible to the naked eye, but diſcoverable only by the help of the teleſcope.

TEMACHIS, in natural hiſtory, the name of a genus of foſſils, of the claſs of the gypſums, the characters of which are theſe: it is of a ſofter ſubſtance than many of the other genera, and of a bright and glittering hue.

The name is derived from the Greek, τεμαχος, *fruſtulum*, a ſmall irregular fragment; the bodies of this genus being compoſed of an aſſemblage of multitudes of irregular flaky fragments, as are all gypſums; but no genus of them ſo viſible as theſe.

TEMPERAMENT, among phyſicians, denotes the ſame with conſtitution; or a certain habitude of the humours of the human body, whereby it may be denominated hot, cold, moiſt, dry, bilious, ſanguine, phlegmatic, melancholic, &c.

According to Boerhaave, moiſtening, diluting, and temperating ſubſtances are a proper diet for perſons of a hot and acid temperament; and, on the contrary, all heating things are prejudicial to them: whereas, in perſons of a cold and moiſt habit, juſt the reverſe of this obtains. To perſons of a ſanguineous temperament, evacuating and temperating medicines are beneficial, and heating or draſtic ſtimulating things pernicious. Perſons of a melancholy temperament are greatly injured by hot, drying, and acrid ſubſtances; whereas moiſtening, defrigerating, relaxing, emollient ſubſtances, and ſuch as gently diſſolve without any acrimony, are beneficial to them.

TEMPERAMENT, in muſic, is the rectifying or mending the imperfect concords, by transferring to them part of the beauties of the perfect ones.

In order to this, muſicians take a medium between the two, which they call a temperament. Suppoſing then, one tone increaſed, and the others diminiſhed, by half a comma, we ſhould have our thirds major perfect: but ſtill, it is neceſſary to examine, what fifths this ſuppoſition would give. Now it is evident, that a tone-major added to an octave, makes juſt two fifths, thus $\frac{2}{1} \times \frac{9}{8} = \frac{9}{4} = \frac{3}{2} \times \frac{3}{2}$. But the tone here added is a tone major, and the tone we have aſſumed is a temperate tone, deficient from the tone major by half a comma; hence the ſum of the two fifths, on this ſuppoſition, will fall ſhort of the truth by $\frac{1}{2}$ of a comma, and conſequently one fifth will be deficient by $\frac{1}{4}$ of a comma. Which difference, although it be ſenſible, yet experience ſhews, that fifths ſo diminiſhed are tolerable.

This is what is called the common or vulgar temperament, and conſiſts, as has been ſaid, in diminiſhing the fifth by $\frac{1}{4}$ of a comma, in preſerving the third major perfect, and dividing it into two equal tones. Which being ſuppoſed, it follows that the fourth muſt exceed the truth by $\frac{1}{4}$ of a comma; that the third minor will be deficient by the ſame quantity; that the ſixty minor will be perfect, and the ſixth major redundant by $\frac{1}{4}$ of a comma; and laſtly, that the ſemitone major will exceed the truth by $\frac{1}{4}$ of a comma. If we introduce chromatic notes, or flats and ſharps, the ſemitone minor will alſo exceed the truth by $\frac{1}{4}$ of a comma, and conſequently the difference between the two ſemitones, or the dieſis enharmonica, will be preſerved.

There are alſo other temperaments propoſed by different authors; as that of 31 parts by Mr. Huygens; Mr. Sauver's of 43, Mr. Henfling's of 50, and that of 12.

TEMPERATURE, or *Climate for Plants*.—The difference of climate or temperature of the air has a very great effect on plants. The different degree of heat is the great cauſe of thoſe changes, and the different degree of moiſture ſomewhat aſſiſts in it. The American and Aſiatic plants, famous in medicine when of the growth of their native ſoils, yet when removed into our climate, though they grow and even produce their flowers and ripen their ſeeds, which ſeems the laſt perfection of a plant, when put to the trial, have been always found to want their proper medicinal virtues.

Many of thoſe plants and trees, which, though natives of another climate, will endure the open air with us, and grow in our gardens; yet loſe much of their ſtrength, and become dwarfs, in proportion to what they were when in their proper climate. But much leſs violent changes than theſe are able to produce the like effects, at leaſt in ſome degree. The ſeveral parts of Europe are able to alter the quality of the ſame plant, even while it grows naturally in them. Thus, the blue aconite or napellus, the root of which is a terrible poiſon in the ſouth of France; yet in Brittany, a northern province of the ſame kingdom, the root of the ſame plant, though it ſeems to grow with equal vigour there, is equally large and ſucculent, has no bad effects; but has been eaten by old people and children without any injury.

In general, the farther north we go the leſs and leſs hurtful this plant becomes. It is common to almoſt all Europe, and we find the inhabitants of ſome places dreading it, and that, with great juſtice, as a fatal poiſon; while thoſe of others eat the leaves in their ſallads, and even eſteem them good to reſtore the appetite.

The common wood which ſucceeds well in many parts of England, is not ſo certain in France; but the different climates, in different parts of that great kingdom, make ſtrange alterations in its juices. In Upper Languedoc they raiſe great quantities of it, and it makes an extremely fine blue dye for ſtuffs of all kinds; but, in Brittany, though the plant grows as high, and ſeems to flouriſh as well, yet the leaves are never ſo ſucculent, and the colour obtained from them is not of ſo fine a blue, but is duſky and browniſh.

This effect of the different climates, in changing the nature of things produced in them, is not confined to plants; but the animal kingdom ſhares in it. The whole ſerpent kind are in general larger and more venomous, as we approach the hotter climates.

The differences, made by variety of climates upon plants, are not limited to diſtance of place, but even in the ſame province the climate differs greatly in different years, by means of accidents, and more or leſs heat; and more or leſs moiſture will do as much violence to plants ſometimes, as change of place, which only operates by means of the ſame agents. Our farmers complain of great miſchiefs, from long droughts; and the French huſbandmen, in many of the provinces, always find, that when there has fallen very much rain, or thick fogs have been very frequent, all the bread-corn of every kind degenerates; the wheat and barley are poor and thin in the ear, and the grain ſmall; but the rye becomes ſo altered, that it is pernicious to uſe it in making of bread; and the poor, who are obliged to eat the bread made with it, are ſubjected to many diſeaſes by it. They call the rye thus vitiated *ergot* and *blé cornu*.

TEMPERING *of Steel and Iron*, the rendering them either more compact and hard, or ſoft and pliant, according as the different uſes for which they are wanted may require.

This operation conſiſts in plunging them, while red hot, into ſome liquor prepared for the purpoſe; ſometimes in pure water, as lockſmiths, &c. which ſeldom uſe any other: and ſometimes a compoſition of divers juices, liquors, &c. is uſed; which is various according to the manner and experience of the workman; as vinegar, mouſe-ear water, the water oozing from broken glaſſes, ſoot, ſalt, oil, &c. To harden and temper Engliſh, Flemiſh, and Swediſh ſteel, they muſt have a pretty high heat given them, and then be ſuddenly quenched in water to make them hard: but Spaniſh and Venetian ſteel require no more than a blood-red heat before it is quenched.

If the ſteel be too hard or brittle for an edged tool, &c. take it down by rubbing a piece of grind-ſtone or whet-ſtone hard upon the work, to take off the black ſcurf: then brighten or heat it in the fire, and as it grows hotter, you will ſee the colour change by degrees, coming firſt to a ſtraw or light gold-colour, then to a darker gold-colour, and at laſt to a blue colour.

Chooſe ſuch of theſe colours as the work requires, then quench it ſuddenly in the water. The light-gold colour is for files, cold chiſſels, and punches to punch iron and ſteel: the dark gold-colour, for punches to uſe on braſs, &c. the blue colour gives the temper for ſprings.

The tempering of files and needles is performed after a peculiar manner.

The ancients appear to have had ſome better method of tempering, than any the moderns are acquainted withal; witneſs their works in porphyry, a ſtone ſo hard that none of our tools make an impreſſion upon it. See the article STEEL.

TEMPLARS, TEMPLERS, *or Knights of the* TEMPLE, a religious military order, inſtituted at Jeruſalem, about the year 1118; the origin of which was as follows:

Some religious gentlemen put themſelves under the government of the patriarch of Jeruſalem, renounced property, made the vow of celibacy and obedience, and lived like canons regular. At firſt, there were but nine of this order, the chief of whom were Hugo de Paganis, and Geoffrey of St. Omers. Theſe religious having neither church nor houſe belonging to the ſociety, king Baldwin gave them an apartment in his palace, which ſtood over-againſt the ſouth gate of the church dedicated to Our Saviour. The canons of this church gave them part of their ſtreet adjoining, upon certain conditions either of rent or ſervice. They had likewiſe lands given them by the king, the patriarch, and the nobility, for their maintenance; and the buſineſs of their character was to guard the roads for the ſecurity of pilgrims.

For the firſt nine years, they were confined to the number of nine. After this term, a rule was drawn up for them, and a white habit aſſigned them by pope Honorius II. And now their numbers were left at liberty, and their eſtates began to improve. About twenty years after, in the popedom of Eugenius III. they had red croſſes ſewed upon their cloaks, as a mark of diſtinction; and, in a ſhort time, their number was increaſed to about three hundred knights, in their convent at Jeruſalem; beſides great numbers in other parts of Chriſtendom, where their revenues exceeded thoſe of many princes. They took the name of Knights Templars, becauſe their firſt houſe ſtood near the church dedicated to Our Saviour at Jeruſalem.

This order of knights, after having done many fine and ſingular actions againſt the Infidels, was become rich and powerful all over Europe; but the knights abuſing their wealth and credit, fell into great diſorders and irregularities. Two of them, who were condemned for their crimes, accuſed the whole order. King Philip the Fair, who hated the Templars, received the depoſitions of theſe two informers, acquainted Clement V. with it, and cauſed all the knights to be apprehended, on the 5th of October 1307. The king took poſſeſſion of their houſe at Paris, and ſeized all the poſſeſſions they had in the kingdom.

The witneſſes, who depoſed againſt them, alleged, that the knights when they entered into that order, renounced Jeſus Chriſt, and ſpit upon a crucifix: that they were addicted to ſodomy; and that they worſhipped a gilded wooden head, which had a long beard; and committed many other abominable and impious pranks. The knights confeſſed ſome of thoſe crimes when they were put to the torture; and the like examinations were made in the other provinces of the kingdom. Some of the principal Templars, by the king's order, were brought to Poitiers, where the pope was, who examined them himſelf; and, upon their confeſſion, commanded the ordinaries to proceed againſt them in their dioceſes, and decreed, that their eſtates ſhould be reſerved for the ſuccours of the Holy Land.

The pope and the king, having agreed to deſtroy the order, proceeded againſt them before eccleſiaſtical commiſſioners appointed by the pope. Theſe commiſſioners met at Paris, in November 1309, to hear the depoſitions of witneſſes, and the defences of the accuſed. Among the Templars that were brought to Paris, there were ſeventy-nine, who maintained the innocence of their order. Fifty-nine, who perſiſted in the denial of what they had confeſſed before, were delivered over to the ſecular arm, and condemned to be burnt; which ſentence was executed, without St. Anthony's gate, at Paris, in March 1310. They were likewiſe proſecuted in Italy, in Spain, and other ſtates. In fine, the pope, by his bull of the 22d of May 1312, given in the council of Vienna, pronounced the extinction of the order of the Templars, united their eſtates to the order of St. John of Jeruſalem, and remitted the judgment of particular ones to provincial councils. The king kept two-thirds of the moveables of the order, on pretence of the expence he had been at in carrying on the proceſs againſt him. In Arragon, the pope united their eſtates to the order of Calatrava. However, the king of Arragon reſerved to himſelf ſeventeen ſtrong places, which had belonged to them. Ferdinand king of Caſtile united to his domain the cities, lands, and other poſſeſſions, which they had in his kingdom. Out of their eſtates the king of Portugal founded the order of the knights of Chriſt; and in England they were united to the order of the Hoſpitallers.

It is a queſtion among hiſtorians, whether the knights Templars were really guilty of the crimes laid to their charge, or whether the vaſt eſtates they were poſſeſſed of were not the occaſion of their ruin. As to the confeſſion ſome of them made of their guilt, the advocates for their innocence impute it to the force of racks and tortures.

TEMPLE, a general name for places of public worſhip, whether Pagan, Chriſtian, or otherwiſe. But the word in a reſtrained ſenſe, is uſed to denote the places, or edifices, in which the Pagans offered ſacrifice to their falſe gods. Thus we hear of the temples of Jupiter, Apollo, Bacchus, &c.

The origin of temples is not ſo early as that of religion. The firſt generations of men worſhipped towards heaven in the open air. The Perſians had no temples, as not thinking the god to be of human ſhape: which was the reaſon, ſome think, why Xerxes burnt and demoliſhed the temples of Greece. The Greeks originally worſhipped their gods upon the tops of high mountains. The ſame cuſtom is atteſted in many places of ſcripture; and the antiquity of it is evident from the hiſtory of Abraham, who was commanded by God himſelf to offer up his ſon upon one of the mountains in the land of Moriah.

Who it was that erected the firſt temple, is not agreed by ancient writers. Some aſcribe it to Phoroneus the Egyptian, others to Merops, and others to Æacus the ſon of Jupiter, &c. Many are of opinion, that temples owe their firſt riſe to the ſuperſtitious reverence paid by the ancients to their deceaſed friends; and as moſt of the gods were men deified on account of their great virtues, ſo temples are thought to have been no more, at firſt, than ſtately monuments erected in honour of the dead. Nor is it any wonder, that monuments ſhould at length be converted into temples, when at every common ſepulchre it was uſual to offer prayers, ſacrifices, and libations.

Temples were built and adorned with all poſſible ſplendor and magnificence, partly out of the great reſpect they bore to the gods, and partly to create an awe and reverence in the worſhippers. They were conſtructed in the manner which was thought moſt agreeable to the gods, to whom they were dedicated. Thus Jupiter, they thought, took moſt delight in pillars of the Doric order; Bacchus in the Ionic; and Veſta in the Corinthian: though this rule was not univerſally or conſtantly obſerved. As to the places where temples were built, they made choice of theſe with a view to the diſpoſition of particular deities. Hence ſome were erected on the tops of mountains, others in vallies, and others in cities. Thoſe built in the country were generally ſurrounded with groves ſacred to the tutelar deity of the place; and wherever they ſtood, it was ſo contrived, that the windows being opened might receive the rays of the riſing ſun. The moſt ancient ſituation was with the front towards the weſt, and the altars and ſtatues at the eaſt end, it being a cuſtom among the Heathens to worſhip with their faces towards the eaſt. But, in after ages, they placed the front of temples towards the eaſt, ſo as that the doors being open ſhould receive the riſing ſun. If the temples were built by the ſide of a river, they were to look towards the banks of it: if near the highway, they were ſo ſituated that travellers might have a fair

a fair proſpect of them, and pay their devotion as they paſſed by.

Temples were divided into two parts: the one called Αδυτον, *Adytum*, which was the inmoſt receſs of the building, and deemed ſo ſacred, that none but the prieſts were allowed to enter into it: the other was open, and free to all who came to pay their worſhip. In the middle of the temples ſtood the images of the gods, on pedeſtals raiſed above the height of the altar, and enclоſed with rails.

Temples, according to the number and difference of their columns, were divided into tetraſtyle, proſtyle, amphiproſtyle, periptere, diptere, &c.

Tetraſtyle TEMPLE, was a temple that had four columns in front, and as many behind,—as the temple of Fortuna Virilis at Rome.

Proſtyle TEMPLE, that which had only columns in its front or foreſide,— as that of Ceres, at Eleuſis, in Greece.

Amphiproſtyle, or *Double proſtyle* TEMPLE. — That which had columns both before and behind, and which was alſo tetraſtyle.

Periptere TEMPLE, that which had four rows of inſulated columns around, and was hexaſtyle, that is, had ſix columns in front, — as the temple of Honour at Rome.

Diptere TEMPLE, that which had two wings, and two rows of columns around, and was alſo octoſtyle, or had eight columns in front,—as that of Diana at Epheſus.

TEMPLES, among us, denote two inns of court, thus called, becauſe formerly the dwelling-houſe of the knights Templars.

TEMPLES, *Tempora*, in anatomy, a double part of the head, reaching from the forehead and eyes to the two ears.

TEMPORAL, a term generally uſed for ſecular, as a diſtinction from eccleſiaſtical. Thus we ſay temporal lords, and ſpiritual or eccleſiaſtical lords.

TEMPORALIS, in anatomy. See the article CROTAPHITES.

TEMPORIS Os, in anatomy, a bone on each ſide the head, thus denominated from its ſituation in the temples.

The figure of the os temporis is nearly circular; the fore and upper parts are very thin, conſiſting only of one table; the lower and hind parts are thick, hard, and uneven.

It is joined to the os ſincipitis by the ſquammous ſuture, whence in that part it is called os ſquammoſum; its lower part is joined to the os occipitis and ſphenoides, to which latter, as likewiſe to the bones of the upper jaw, it is joined by means of certain proceſſes, and in that part is called os petroſum.

Each of the oſſa temporum has two ſinus's, the exterior of which is lined with a cartilage and receives a proceſs of the lower jaw; the interior receives the lower part of the ſinus lateralis of the dura mater. Each likewiſe has four proceſſes; the os jugale, proceſſus mamillaris, ſtyloides, and os petroſum.

TENAILLE, in fortification, a kind of out-work, reſembling a horn-work, but generally ſomewhat different; for inſtead of two demi-baſtions, it bears only in front a re-entering angle betwixt the ſame wings without flanks; and the ſides are parallel.

Tenaille double or flanked, is a work, whoſe front conſiſts of four faces, making two re-entering angles, and three ſaliant; the wings or ſides of this work being in like manner correſpondent in the front of the gorge.

Tenaille ſimple, a work having its front formed by two faces, which make a re-entering angle, the ſides running directly parallel from the head to the gorge.

Tenaille of the place, is that which is comprehended between the points of two neighbouring baſtions; that is to ſay, the curtain, the two flanks that are raiſed on the curtain, and the two ſides of the baſtions which face one another, ſo that it is the ſame with what is otherwiſe called the face of the fortreſs.

Tenaille of the foſs, is a low work raiſed before the curtain in the middle of the foſs: it is of three ſorts; the firſt is compoſed of a curtain, two flanks, and two faces; the rampart of the curtain, including the parapet and talus, is but five fathom thick, but the rampart of the flanks and faces is ſeven. The ſecond is compoſed only of two faces made on the lines of defence, whoſe rampart and faces are parallel. The third ſort differs from the ſecond, only in this, that its rampart is parallel to the curtain of the place. All three ſorts are good, and cannot be hurt by the beſiegers cannon, till they are maſters of the covert-way, and have planted their cannon there.

All tenailles are defective in this reſpect, that they are not flanked or defended towards their inward or dead angle; becauſe the height of the parapet hinders ſeeing down before the angle, ſo that the enemy can lodge himſelf there under covert: wherefore tenailles are never made but when they want time to make a horn-work.

TENANT, or TENENT, in law, one that holds or poſſeſſes lands or tenements of ſome lord or landlord, by any kind of right, either in fee, for life, years, or at will. The term tenant is uſed with divers additions.—Thus,

TENANT *in Dower*, is ſhe that poſſeſſes lands by virtue of her dower.

TENANT *per Statute Merchant*, he that holds lands forfeited to him by virtue of a ſtatute.

TENANT *in frank Marriage*, is he that holds lands or tenements by virtue of a gift thereof made to him upon marriage between him and his wife.

TENANT *by Courteſy*, holds for his life by reaſon of a child begotten by him of his wife, being an inheritrix, and born alive.

TENANT *by Elegit*, holds by virtue of the writ called an elegit.

TENANT *in Mortgage*, holds by means of a mortgage.

TENANT *by Verge*, in ancient demeſne, is he who is admitted by the rod in court to lands of antient demeſne.

TENANT *by Copy of Court-roll*, is one admitted a tenant of any lands, &c. within a manor, which time out of mind has been demiſed according to the cuſtom of the manor.

TENANT *by Charter*, is he that holdeth by feoffment in writing or other deed.

TENANT *in Capite*, or *Chief*, holdeth of the king in right of the crown.

TENANT *of the King*, is he that holdeth of the perſon of the king.

Joint TENANTS, thoſe who have equal right in lands and tenements by virtue of one title.

TENANTS *in common*, thoſe who have equal right, but hold by divers titles.

Particular TENANT, is he that holds only for his term.

Sole TENANT, is he who hath no other joined with him.

TENANT *by Execution*, is he who holds by virtue of an execution upon any ſtatute, recognizance, &c.

TENANT, or TENAN, in heraldry, is uſed for ſomething that ſuſtains or holds up the ſhield, or armory, and is generally ſynonymous with ſupporter.

TENAR, in anatomy. See the article THENAR.

TENCH, in ichthyology, the Engliſh name of the tinca of modern authors, the fullo and gnapheus of the ancients.

It is, according to the Artedian ſyſtem, a ſpecies of the cyprinus, and diſtinguiſhed by that author by the name of the blackiſh, mucous, or ſlimy cyprinus, with the end of the tail even.

This is a delicately taſted fiſh, though it lives in foul water and ſeems to feed very coarſely. It is always found in the muddieſt parts of ponds, and where there are moſt weeds.

The ſlime of the ſkin of this fiſh is ſaid to be of a healing nature, and to cure all freſh wounds; and it is pretended that the other fiſh know this property in it, and always apply to the tench when wounded. Whether their opinion be true or falſe, the tench has obtained by it the name of the fiſhes phyſician. The pike is ſaid to pay ſuch reſpect to this fiſh, on this account, that he never

never ſeizes him. But theſe are things eaſier to be fancied and ſaid than proved; and, if it ſhould prove that the pike does not eat the tench, it may be reſolved into a much more natural cauſe, by ſuppoſing the ſlime of the tench too diſagreeable in his ſtomach to ſuffer it.

The ſeaſon for angling for tench is in June, July, and Auguſt. The time of their biting is early in the morning, or late in the evening, and, in hot weather, all night long. The favourite bait for the tench is a large red worm, and they will take this much more greedily, if it be dipped in tar, after it is put on the hook. There are ſeveral ſorts of paſte alſo that he bites very well at, particularly one made of brown bread and honey, with an admixture of tar. All paſtes that have any of the ſtrong-ſcented oil in them, are alſo good baits. Other baits are the cad-worm, lob-worm, flag-worm, green-gentle, marſh-worm, or ſoft-boiled bread corn. All theſe will do very well at a proper ſeaſon.

When any number of tench are to be taken out of a muddy pond, where they will not bite freely at the hook, the method is to take a very good and large caſting-net, well leaded, and with the meſhes from the crown to a full yard and a half, not too ſmall; for then if the pond be deep, the fiſh will ſtrike away before the net gets to the bottom. The place where the net is intended to be thrown, muſt be made clean from buſhes and large weeds with a rake. When the place is thus cleared of any obſtacles to the even deſcent of the net, a bait is to be prepared to draw the fiſh together, where the net is to be thrown. This bait is to be thus made: Put a quarter of a peck of wheat into three quarts of water, ſend it to an oven, and let it be well ſoaked: then add to it five pints of blood, and as much bran as is neceſſary to give it the conſiſtence of a paſte. Mix ſome clay with it, that it may the better hold together; and finally, add a quart of lob-worms chopped to pieces. Let the whole be wrought up into a ſtiff paſte, and rolled into balls of the ſize of a hen's egg; and let theſe be thrown into the pond, in the place where the net is to be thrown. At times theſe, and at times ſome grains, are to be thrown in; and the place in this manner thoroughly baited for ſeveral days. When the fiſh may be ſuppoſed to be very well acquainted with the ſpot, let a very good baiting be given in the morning, and in the cloſe of the evening let the caſting-net be carefully thrown in. When the net is ſunk, the mud all about is to be ſtirred up with a long pole, with a fork at the end; the net is to lie half an hour, and the mud to be thus ſtirred all the time; by this means the tench will be raiſed, and will be taken in the pulling out the net; but, if the net were to be thrown in and taken out in the common way, there would hardly be one fiſh taken; for the cuſtom of both tench and carp, when they are frighted, is to plunge their heads up to eyes in the mud, and thus placed, with their tails erect, any net in the world muſt draw over them, without a poſſibility of its entangling them.

TENDER, in a legal ſenſe, ſignifies as much as to offer or endeavour the performance of any thing, in order to ſave the penalty or forfeiture incurred by non-performance.

TENDERS, in the ſea language, are veſſels employed to raiſe ſeamen for the navy, commanded by a lieutenant of one of his majeſty's ſhips; they likewiſe attend large ſhips, and carry ſtores, &c.

TENDON, *Tendo*, in anatomy, that hard, white, extreme part of a muſcle, whereby it is faſtened to the bone. See MUSCLE.

TENEBRÆ, an office in the Romiſh church, performed on Wedneſday, Thurſday, and Friday, in Paſſion Week, at which time, neither flowers nor images are allowed to be ſet upon the altars, but they muſt be covered with purple.

TENEMENT properly ſignifies a houſe; but in a larger ſenſe it is taken for any houſe, land, rent, or other thing, which a perſon holds of another.

TENEMENTARY LANDS, ſuch as are held by the tenant, diſtinguiſhed by that name from the demeſne land of the lord, called inland.

TENEMENTIS LEGATES, a writ that anciently lay to the city of London, or any other corporation, where, according to the old cuſtom, men might deviſe tenements, as well as goods and chattels, by their laſt will; for the determining of any controverſy relating thereto, and for rectifying the wrong tenant.

TENENTIBUS IN ASSISA NON ONERANDIS, a writ which lies for the perſon to whom a diſſeiſor has alienated the land whereof he diſſeiſed another; that he be not arreſted on the damages awarded on the aſſize, if the diſſeiſor has wherewith to ſatisfy them himſelf.

TENESMUS, in medicine, a name given by medical writers, to a complaint which is a continual deſire of going to ſtool, but without any ſtool being ready to be voided. This is uſually attended with ſome tumour, ſometimes with a very conſiderable one in the part. This is properly no primary diſeaſe, but merely a ſymptomatic one, and differs in degree according to the diſeaſe on which it is an attendant. Signs of it are a titillation and itching about the anus, attended with a violent burning pain, and a deſire of compreſſing and voiding ſomething, and this attended uſually with no excrement, or only a pulpous or mucous matter, and very often prolapſus ani, or falling down of the rectum. This diſeaſe happens often to people labouring under hæmorrhoidal diſorders, eſpecially when the diſcharges attending them do not ſucceed regularly, though nature gives all the neceſſary motions for their excretion. It happens alſo to people who are ſubject to void an acrid and bilious matter by ſtool, and not unfrequently to thoſe who have a ſtone in the bladder. Women in the latter part of their time in going with child, have alſo very often terrible fits of it, attended with conſiderable ſwelling; this happens to them from the preſſing of the uterus with its burden, upon the rectum and hæmorrhoidal veins. The cauſes of a teneſmus, beſides thoſe already mentioned, are the aſcarides, a ſmall ſort of worms, which uſually infeſt the rectum, and occaſion a continual itching and tickling there; the abuſe of reſinous purging medicines. Much riding will alſo ſometimes occaſion it.

As the teneſmus is merely a ſymptomatic diſeaſe, the primary diſorder is firſt to be examined, and treated in order to a cure; thus, when it is occaſioned by aſcarides, worm medicines are to be given, and clyſters of a proper kind injected; and when the worms are by this means deſtroyed, the teneſmus, which was no more than a ſymptom, naturally ceaſes. In general, the regimen and method of cure in a teneſmus, are the ſame with thoſe preſcribed in a dyſentery; great relief is afforded by a fomentation of warm milk, in which elder-flowers have been boiled, as alſo by a clyſter of mutton broth, or an emollient clyſter, in which earth-worms have been boiled. The medicines, at preſent, generally uſed for the cure of a teneſmus, are theſe following: take of pulvis ſanctus and rhubarb, each one ſcruple; of the oil of cinnamon, one drop; of London laudanum, half a grain; and of the ſyrup of violets, a ſufficient quantity for making into a bolus, to be taken in the morning, and repeated as the ſituation of the patient requires; at night a paregoric may be exhibited, and clyſters afterwards uſed; for which purpoſe, take of whey, or mutton-broth, four ounces; of canary wine, two ounces; of gum arabic, half an ounce; of gum tragacanth, one dram; and of crude opium, two grains; make into a clyſter, to be injected twice or thrice a day, afterwards continue the following medicine for ſome time: Take of the confection of Fracaſtorius, without honey, one ſcruple; of ſperma ceti, fifteen grains; of the ſpecies of hyacinthæ, japan earth, red coral, and American bole, each eight grains; of the oil of nutmegs, one drop; and ſyrup of red roſes, a ſufficient quantity for making a bolus, to be taken twice a day, in a ſmall quantity of the tincture of red roſes. In a teneſmus, the laſt refuge is to opiates.

TENET, or TENENT, a particular opinion, dogma, or doctrine, profeſſed by ſome divine, philoſopher, &c.

TENNE, TENNY, or TAWNY, in heraldry, a bright colour made of red and yellow mixed; ſometimes alſo called bruſk, and expreſſed in engraving, by thwart, or diagonal ſtrokes or hatches, beginning from the ſiniſter chief, like purpure, and marked with the letter T. In the coats of all below the degree of nobles, it is called tenny; but in thoſe of nobles it is called hyacinth; and in princes coats, the dragon's head.

TENON, in building, &c. the ſquare end of a piece of wood, or metal, diminiſhed by one third of its thickneſs, to be received into a hole in another piece, called a mortiſe, for the jointing or faſtening the two together. It is made in various forms, ſquare, dove-tailed for double mortiſes, and the like.

TENOR, or TENOUR, the purport or content of a writing or inſtrument in law, &c. An action of debt brought upon a judgment in an inferior court, where the defendant pleads, *nul tiel record*, no ſuch record, a tenor thereof only ſhall be certified; and it likewiſe is the ſame on certioraris. A tenor of a libel has been held to be a tranſcript of it.

TENOR, or TENORE, in muſic, the firſt mean, or middle part, or that which is the ordinary pitch of the voice, when neither raiſed to a treble, or lowered to a baſs. The tenor is commonly marked in thorough baſs with the letter T. This is that part which almoſt all grown perſons can ſing; but as ſome have a greater compaſs of voice upwards, others downwards, others are confined to a kind of medium, and others can go equally high or low; hence muſicians make a variety of tenors, as a low, a high, a mean, a natural tenor, to which may be added, a violin tenor, &c. for inſtruments. The Italians uſually diſtinguiſh two kinds of tenor, *tenore primo*, 1° or P°, which anſwers to our upper tenor; and *tenore ſecundo*, 2°. or II°, which is our natural tenor, confounding the counter-tenors, &c. under the name of baritono.

TENSE, TIME, in grammar, an inflexion of verbs, whereby they are made to ſignify or diſtinguiſh the circumſtance of time of the thing they affirm or attribute.

The affirmations made by verbs are different, as to the point of time; ſince we may affirm a thing is, or was, or will be, hence, a neceſſity of a ſet of inflexions, to denote thoſe ſeveral times, which inflexions our Engliſh grammarians call by a barbarous word tenſes from the French *temps*; moſt other languages call them ſimply times.

There are but three ſimple tenſes; the preſent, as I love, *amo*; the preter, preterit, or paſt, as I have loved, *amavi*; and the future, as I will love, *amabo*.

But, in regard, in the preter tenſe, one may either expreſs the thing as juſt done, or paſt, or indefinitely, and barely that it was done; hence, in moſt languages ariſe two kinds of preterits; the one definite, marking the thing to be preciſely done, as I have written, I have ſaid; and the other indefinite, or aoriſt, denoting a thing done indeterminately, as I wrote, I went. The future tenſe admits of the ſame variety. Beſides the three ſimple tenſes, others have been invented, called compound tenſes, expreſſing the relation of ſimple ones to each other. The firſt expreſſes the relation of the paſt to the preſent, and is called the preterimperfect tenſe, becauſe it does not mark the thing ſimply and properly as done, but as imperfect, and preſent with reſpect to another thing paſt; as I was at ſupper, when he entered, *Cum intravit, cœnabam*.

The ſecond compound tenſe marks the time paſt doubly, and is therefore called *pluſquam* perfect tenſe, as I had ſupped, *cœnaveram*.

The third compound tenſe denotes the future, with reſpect to the paſt; as I ſhall have ſupped, *cœnavero*.

The ſeveral tenſes or times, it is to be obſerved, are properly denoted in the Greek and Latin by particular inflexions; in the Engliſh, French, and other modern tongues, the auxiliary verbs to be and to have, *etre & avoir*, are called in.

As to the Oriental languages, they have only two ſimple tenſes, the paſt and future, without any diſtinction of imperfect, more than perfect, &c. which renders thoſe languages ſubject to abundance of ambiguities, which others are free from.

TENSION, *Tenſio*, the ſtate of a thing bent, or the effort made to bend it.

Animals only ſuſtain and move themſelves by the tenſion of their muſcles and nerves. A chord or ſtring gives an acuter or deeper ſound, as it is in a greater or leſs degree of tenſion.

TENT, a pavilion or portable lodge.

TENT, in ſurgery, a roll of lint worked into the ſhape of a nail, with a broad flat head. Tents differ in thickneſs and length, according to the ſize of the wound for which they are intended, and are chiefly uſed in deep wounds and ulcers. They are of ſervice not only in conveying medicines to the moſt intimate receſſes and ſinuſes of the wound, but to prevent the lips of the wound from uniting, before it is healed from the bottom; and by their aſſiſtance grumous blood, ſordes, &c. are readily evacuated. They ought to be made extremely ſoft, that the cure of the wound may not be retarded by the pain they would otherwiſe bring on.

There is another kind of tents made of linen rags not ſcraped, and worked up into a conical form, to the baſis of which is faſtened a long thread; the apex of this tent muſt be a little unravelled, to make it ſofter, leſt it may become painful: the thread is faſtened to the baſis, that the tent may be recovered with the greater eaſe, if, by any accident, it ſhould be forced into the cavity of the thorax or abdomen; for the tents we now deſcribe, are chiefly uſed to keep open wounds that penetrate into the cavity of the thorax or abdomen, in order to make way for the proper diſcharge of blood, matter, &c. There is a third ſort of tents, which ſerve not only to keep open, but to enlarge, by degrees, the mouth of any wound or ulcer which ſhall be thought too ſtrait; that, by this means, a free paſſage may be procured for the blood and matter that were confined, and that proper medicines may find a more ready admittance. Theſe tents are made either of ſponge, prepared in a certain manner; or of dried roots of gentian, calamus aromaticus, &c. for their ſubſtances imbibe the matter which flows to them, and being preſently enlarged dilate the lips of the wound.

TENTER, TRIER, or PROVER, a machine uſed in the cloth manufactory, to ſtretch out the pieces of cloth, ſtuff, &c. or only to make them even and ſet them ſquare.

It is uſually about four feet and a half high, and for length exceeds that of the longeſt piece of cloth.—It conſiſts of ſeveral long ſquare pieces of wood, placed like thoſe which form the barriers of a manege, ſo, however, as that the lower croſs piece of wood may be raiſed or lowered, as is found requiſite, to be fixed at any height by means of pins.—Along the croſs pieces, both the upper and under one, are hooked nails, called tenter-hooks, driven in from ſpace to ſpace.

To put a Piece of Cloth on the TENTER: While the piece is yet quite wet, one end is faſtened to one of the ends of the tenter; then it is pulled by force of arms towards the other end, to bring it to the length required: that other end being faſtened, the upper liſt is hooked on to the upper croſs-piece, and the loweſt liſt to the lower croſs-piece, which is afterwards lowered by force till the piece have its deſired breadth.—Being thus well ſtretched, both as to length and breadth, they bruſh it with a ſtiff hair-bruſh, and thus let it dry.—Then they take it off; and, till they wet it again, it will ſtill retain the width and breadth the tenter gave it.

TENURE, in law, the manner or condition wherein a tenant holds lands or tenements of his lord; or the ſervices performed to the lord, in conſideration of the uſe and occupancy of his lands.

TEPID, in natural hiſtory, a term uſed by writers on mineral waters, to expreſs ſuch of them as have a leſs ſenſible cold than common water.

They diſtinguiſh all the medicinal ſprings into three kinds; the hot, the tepid, and the cold; but the middle term might eaſily be underſtood to mean a great deal more than they expreſs by it; all that have what can be called the leaſt ſenſible warmth, are called hot; and the tepid are diſtinguiſhed from the abſolutely cold, only by their being leſs cold.

Some of this claſs of mineral waters, and ſome few alſo of the cold ones, have a ſharpiſh vinous taſte, which is never obſerved in any of the hot ones. This taſte is loſt on the giving the waters the ſlighteſt heat, and is therefore very difficult to be gueſſed at as to its origin. It is not only found in the aluminous and vitriolate waters, but alſo in thoſe which are manifeſtly nitrous, and which abound in ſulphureous ſalts, quite different in their na-

ture from acids. It is therefore an additional ſomewhat, quite diſtinct from the ſaline properties of the fluid, and as eaſily connected with one kind of that as with the others.

The cauſes of heat in the mineral waters remain yet wholly unknown, notwithſtanding all that has been written concerning them. It is hard to believe, that there are continual ſubterranean fires near enough the ſurface, to give a heat that preſerves itſelf in ſo great a degree to the very place of their eruptions; and it is equally hard to conceive, that there can be beds of fermenting mineral matters, ſufficient in quantity and force to have given the ſame degree of heat to waters for ſo many ages, as ſome of our hot ſprings are known to have ſubſiſted. *Duclos's Exam. des Eaux Miner.*

TEREBINTHUS, the turpentine tree. See TURPENTINE.

TEREDO, a name given by naturaliſts to a ſpecies of ſea-worm, which eats its way into the bottoms of ſhips, lining the hole it makes with a kind of ſhelly matter.

The head of this creature is well prepared by nature for the hard offices it is to undergo, being coated with a ſtrong armour, and furniſhed with a mouth like that of the leech; by which it pierces wood, as that animal does the ſkin. A little above this it has two horns, which ſeem a kind of continuation of the ſhell. The neck is as ſtrongly provided for the ſervice of the creature as the head, being furniſhed with ſeveral ſtrong muſcles. The reſt of the body is only covered by a very thin and tranſparent ſkin, through which the motion of the inteſtines is plainly ſeen by the naked eye; and, by means of the microſcope, ſeveral other very remarkable particulars become viſible there.

At that part where the inteſtines end, the tail begins; this is longer than all the reſt of the body; it is depreſſed in the middle, and puffed out on each ſide, and is joined to the callous part of the lower end of the body in an irregular manner, ſo that there is an intermediate void ſpace left between: this occupies the middle part between what the natural hiſtorians call two ſoleæ-form fins. This creature is wonderfully minute, when newly excluded from the egg, and at its utmoſt bigneſs is a foot long; three or four inches is however its more frequent length.

The ſkin of this little animal being ſtripped off, the heart, ſtomach, and inteſtines come plainly in view, as alſo the callous muſcles of the neck, and two white ovaries; the heart is compoſed of two pyramidal veſſels.

TERES, in anatomy, a name given to two muſcles of the arm; one is called teres major, and is one of the depreſſor muſcles, which has its origin at the lower angle of the ſcapula, and its termination three fingers below the head of the humerus: the other is called teres minor, being one of the abductor-muſcles, and having its origin at the inferior coſta of the ſcapula; this, together with the infraſpinatus, properly forms one conjunct muſcle, having at the extremity, only a ſingle tendon, which is inſerted into the poſterior part of the neck of the humerus.

TERM, *Terminus*, in general, ſignifies much the ſame with boundary or limit.

TERM, in law, is generally taken for a limitation of time or eſtate; as a leaſe for term of life, or years, which is deemed a chattel real.

Term, however, is more particularly uſed for that time wherein our courts of juſtice are open; in oppoſition to which, the reſt of the year is called vacation. There are four of theſe terms in a year, viz. 1. Hilary-term, which begins on Jan. 23. but if that is a Sunday, the next day, and ends on Feb. 12. 2. Eaſter-term, which begins the Wedneſday fort-night after Eaſter-day, and ends the Monday next after Aſcenſion-day. 3. Trinity-term, which begins on the firſt Friday after Trinity Sunday, and ends the Wedneſday fortnight after. 4. Michaelmas term, which begins on Nov. 6. and ends the 28th of the ſame month.

It has been held, that courts do not ſit except in term-time, as to giving of judgments, &c. and in every term there are four days, thus diſtinguiſhed; that is, the eſſoin-day, the day of exceptions, the day of return of writs, and day of appearance. On the eſſoin-day the term is ſaid to begin, when one judge ſits in each of the courts of Weſtminſter, in order to take and enter eſſoins: but it is not till three days afterwards, that all the judges ſit for the diſpatch of buſineſs. There are likewiſe different returns in different terms, ſome having more, ſome fewer: and as, in the king's bench, all returns are to be made on ſome particular day of the week in each term, care muſt be taken not to make the writs out of that court returnable on a non-judicial day, as Sunday, All-Saints, &c.

Oxford-TERMS. Hilary, or Lent-term begins on Jan. 14. and ends the Saturday before Palm-Sunday. Eaſter-term begins the tenth day after Eaſter, and ends the Thurſday before Whitſunday. Trinity-term begins the Wedneſday after Trinity-Sunday, and ends after the act, ſooner or later, as the Vice-Chancellor and convocation pleaſe. Michaelmas-term begins on Oct. 10. and ends Dec. 17.

Cambridge-TERMS. Lent term begins on Jan. 13. and ends the Friday before Palm-Sunday. Eaſter-term begins the Wedneſday after Eaſter-week, and ends the week before Whit-Sunday. Trinity-term begins the Wedneſday after Trinity-ſunday, and ends the Friday after the commencement. Michaelmas-term begins Oct. 10. and ends Dec. 16.

Scottiſh-TERMS. In Scotland, Candlemas term begins Jan. 23, and ends Feb. 12. Whitſuntide-term begins May 25, and ends June 15. Lammas-term begins July 20, and ends Aug. 8. Martinmas-term begins Nov. 3, and ends Nov. 29.

TERM, in grammar, denotes ſome word or expreſſion of a language.

TERM *in the arts*, or TERM *of art*, is a word which, beſides the literal and popular meaning which it has, or may have, in common language, bears a further and peculiar meaning in ſome art or ſcience.

TERM, in logic. A propoſition is ſaid to conſiſt of two terms, i. e. two principal and eſſential words, the ſubject, and the attribute.

TERMS *of an Equation*, in algebra, are the ſeveral names or members of which it is compoſed, and ſuch as have the ſame unknown letter, but in different powers or degrees: for if the ſame unknown letter be found in ſeveral members in the ſame degree or power, they ſhall paſs but for one term.

As in this equation, $xx + ax = bb$; the three terms are $x\,x$, $a\,x$, and $b\,b$. Moreover, in this, $x^4 + x^3 + x^2 + \frac{ab}{cd}x + \frac{fp}{rs}x + yy = 0$; the terms are x^4, x^3, x^2, $\frac{ab}{cd}$ $+ \frac{fp}{rs} \times x$, and $y\,y$. Where $\frac{ab}{cd}\,x$, and $\frac{fp}{rs}\,x$, are the ſame terms; and the firſt term in any equation muſt be that where the unknown root hath the higheſt dimenſions; and that term which hath the root in it, of one dimenſion of power lower, is called the ſecond term, and ſo on.

TERMS *of Proportion*, in mechanics, are ſuch numbers, letters, or quantities, as are compared one with another.

Thus, if $\begin{matrix} 2 : 4 :: 8 : 16 \\ a : b :: c : d \end{matrix}$, then a, b, c, d, or 2, 4, 8, 16, are called the terms; a being the firſt term, b the ſecond term, &c.

TERMS, or COURSES, in medicine, the menſes, or womens monthly purgations. See MENSES.

TERMINATION, *Terminatio*, in grammar, the ending of a word, or laſt ſyllable thereof.

It is the different termination of one and the ſame words on different occaſions, that conſtitute the different caſes, numbers, tenſes, and moods, &c.

TERRA, EARTH, in geography and aſtronomy. See EARTH.

TERRA FIRMA, in geography, is ſometimes uſed for a continent, in contradiſtinction to iſlands.

Thus Aſia, the Indies and South America, are uſually diſtinguiſhed into terra firmas and iſlands.

TERRA A TERRA. Gallies, and other veſſels are ſaid to go terra a terra, when they never go from the coaſts.

The

The phraſe is alſo applied, in the manege, to horſes which neither make curvets nor balotades, but run ſmoothly on the ground, on a preſſed gallop, only making little leaps or riſings with the fore feet.

TERRÆ-FILIUS, ſon of the earth, a ſtudent in the univerſity of Oxford, formerly appointed, in public acts, to make jeſting and ſatyrical ſpeeches againſt the members thereof, to tax them with any growing corruptions, &c.

TERRA VERTE, in natural hiſtory, a native earth, which in all probability is coloured by copper.

It is of a blue green colour, much of that tint which is called ſea-green. What we have in common here, is not very bright, but being ſemi-tranſparent in oil, and of a ſtrong body in water, and ſtanding equally well with the beſt pigments, it is very much adapted to anſwer ſome purpoſes in both kinds of painting; though it is not ſo generally uſed by thoſe to whom it would be ſerviceable as it merits. Mr. D'Acoſta ſays, in his book of Foſſils, that there is a kind which is very bright, and is found in Hungary: if it could be procured here, it would certainly be a very valuable acquiſition to oil painting; as the greens we are forced at preſent to compound from blue and yellow, are ſeldom ſecure from flying or changing.

Terra verte, as brought from abroad, is of a very coarſe texture; and requires to be well levigated, and waſhed over: but no other preparation is neceſſary previouſly to its uſe. The only method of diſtinguiſhing its goodneſs is by the brightneſs and ſtrength of its colour.

TERRACE, or TERRAS, a walk or bank of earth, raiſed on a proper elevation, ſo that any perſon who walks round a garden, may have a better proſpect of all that lies round him; and theſe elevations are ſo neceſſary, that thoſe gardens which are flat, and that have them not, are deficient.

When the terraces are rightly ſituated, they are great ornaments, eſpecially when they are well made, and their aſcent not too ſteep.

There are ſeveral kinds of terrace walks. 1. The great terrace, which generally lies next to the houſe. 2. The ſide terrace, which is commonly raiſed above the level of the parterre, lawn, &c. 3. Thoſe terraces which encompaſs a garden.

As to the breadth of ſide terraces, this is uſually decided by its correſpondence with ſome pavilion, or ſome little jettee or building; but moſt of all by the quantity of ſtuff that is to ſpare for thoſe purpoſes.

The ſide terrace of a garden ought not to be leſs than twenty feet, and ſeldom wider than forty.

As for the height of a terrace, ſome allow it to be but five feet high, but others more or leſs, according to their fancies; but more exact perſons never allow above five or ſix feet, but in a ſmall garden, and a narrow terrace walk, three feet; and ſometimes three feet and a half high are ſufficient for a terrace twelve feet wide, and four feet are ſufficient for a terrace of twenty feet wide; but when the garden is proportionably large, and the terrace is thirty or forty feet wide, then it muſt be at leaſt five or ſix feet high.

The nobleſt terrace is very deficient without ſhade, for which elm-trees are very proper; for no ſeat can be ſaid to be complete, where there is not an immediate ſhade almoſt as ſoon as out of the houſe, and therefore theſe ſhady trees ſhould be detached from the body and wings of the edifice. *Miller's Gard. Dict.*

TERRACE is alſo applied to the roofs of houſes that are flat, and whereon one may walk; as alſo to balconies that project.

TERRAQUEOUS, in geography, an appellation given to our globe, becauſe conſiſting of land and water. See EARTH and SEA.

TERRE-PLEIN, in fortification, denotes the horizontal ſuperficies, or top, of the rampart, between the inferior talus and the banquette. It is thus called, as lying nearly level, with only a little ſlope inwardly, to bear the recoil of the cannon.

TERRELLA, *μικρὸν*, an appellation given to a loadſtone, when turned into a ſpherical figure, and is placed ſo, that its poles and equator, &c. correſpond to the poles and equator of the world; as being a juſt repreſentation of the great magnetical globe which we inhabit.

Such a terrella, if nicely poiſed and placed in a meridian, it was imagined, would turn about its axis once in twenty-four hours; but experience has ſhewn this to be a miſtake.

TERRESTRIAL, ſomething partaking of the nature of earth, or belonging to the globe of the earth: thus we ſay, the terreſtrial globe, line, &c. See GLOBE, EARTH, LINE, &c.

TERRITORY, in geography, denotes an extent or compaſs of land, within the bounds or belonging to the juriſdiction of any ſtate, city, or other ſubdiviſion of a country.

TERTIAN, in medicine, an ague, or intermitting fever, the fits of which return every third day; that is, there are two fits in three days, the day intervening being without any fit at all.

A regular tertian is attended with the following ſymptoms: at firſt, the head achs, the limbs ſeem weary, there is a pain in the loins about the firſt vertebræ of the back, which tends towards the epigaſtrium, with a painful ſenſation of a tenſion in the hypochondria, and coſtiveneſs: then comes on a coldneſs of the external parts, eſpecially of the noſe and ears, a ſtretching, yawning, ſhivering, and ſhaking, ſometimes ſo much as to make the bed tremble under them; the pulſe is ſmall, contracted, and weak; ſometimes the patient is troubled with thirſt; then follows a nauſea, with a fruitleſs reaching to vomit: and to theſe ſymptoms there ſucceeds an anxious burning and dry heat, which pervades the whole body; the pulſe becomes full and thick, the reſtleſſneſs increaſes, the breathing is more difficult, and the patient, with his eyes almoſt cloſed, begins to talk a little wildly. However, the duration of the fit is uncertain, continuing ſometimes ten or eleven hours, and ſometimes twenty-four.

As to the method of cure, it differs but little from that recommended for quartans. See the articles QUARTAN and INTERMITTENT.

TERTIATE *a great Gun*, in gunnery, is to examine the thickneſs of the metal at the muzzle; whereby to judge of the ſtrength of the piece, and whether it be ſufficiently fortified or not. This is uſually done with a pair of calliber-compaſſes, and if the piece be home-bred, the diameter leſs by the height, divided by 2, is the thickneſs at any place.

TESSELATED PAVEMENTS, thoſe of rich Moſaic work, made of curious ſquare marbles, bricks, or tiles, called teſſelæ, from their reſembling dice.

TEST, in metallurgy, a veſſel of the nature of the coppel, uſed for large quantities of metal at once.

Teſts are uſually a foot and a half broad, and are made of wood aſhes, not prepared with ſo much care as for coppel making, and mixed with finely powdered brick-duſt; theſe are made into the proper ſhape either by means of an earthen veſſel of proper dimenſions, or only an iron-ring. To make them in the firſt manner, an earthen veſſel is to be procured, not glazed within, and by its depth and breadth proportioned to the quantity of metal to be worked: the inſide of this veſſel is to be well moiſtened with fair water, that the aſhes to be put into it may adhere the better. Put into this veſſel, thus prepared, the aſhes and brick-duſt beforementioned, and firſt moiſtened either with water alone, or with water with a little white of an egg mixed in it: let the quantity of this be ſo much as will half fill the veſſel, then preſs the maſs with a wooden indented peſtle; or, if not for a very large teſt, with a wooden cylinder only of an inch thick: when thus preſſed down add freſh aſhes, and preſs them in a ſecond time, as in the making of coppels, and repeat this addition of freſh aſhes till the earthen veſſel is nearly full; then remove the ſuperfluous aſhes with an iron-ruler, and let the inequalities remaining at the border, be ſmoothed with a wooden ball rolled round about. This done, you are to cut the cavity with a bowed iron, that you may have a broad ſpherical ſegment, not very deep: and laſtly, by means of a ſieve, ſtrew this cavity carefully and regularly over with dry aſhes of bones of animals, ground extremely fine, and ſqueeze theſe hard in, by the rotation of the wooden ball. Thus you have

a teſt

a teſt finiſhed, which, together with its earthen pot, muſt be ſet in a dry warm place.

To make the teſts in the other manner, or by means of an iron-ring; let a ring of that metal be filled with aſhes, mixed with brick-duſt, and moiſtened as before-mentioned, in ſuch manner that they may riſe conſiderably above the ring; then preſs them ſtrongly, either with your hands, or with an indented peſtle, and afterwards, with gentle blows of a rammer, preſs the aſhes from the circumference towards the center, in a ſpiral line, and that in ſuch a manner, that, after having been ſufficiently preſſed, they may be a ſmall matter higher than the brink of the ring. If there are now any vacancies in the maſs, empty the ring, and fill it again with more aſhes; for, if you ſhould attempt to fill up theſe by adding were it but ever ſo little aſhes, the ſecond or additional quantities will never cohere ſo firmly with the firſt, but that they may probably ſeparate in the operation. This done, turn the ring upſide down, and on the other ſide, or bottom, take out the aſhes to the quantity of one third part of the depth of the ring; and again fill the vacuity with the ſame aſhes, in ſuch a manner that there may remain no ſenſible cavity. When the maſs is thus prepared, cut out a cavity in the larger ſurface of the ring, with a bowed iron, as in the former method.

TEST-LIQUOR, a liquor uſed by dealers in brandies, to prove whether they be genuine, or mixed with home-ſpirits.

The people who uſe this, place great confidence in it, but it is really a very vague and uncertain thing. They pretend, that this liquor will ſhew by the colour which it makes, on being poured into brandy, whether it be genuine and unadulterated; or, if not, in what proportion the adulterating ſpirit is mixed with it.

The whole fact is this: if a little common green or white vitriol be diſſolved in ſome fair water, it makes a teſt liquor; a few drops of which, being let fall into a glaſs of old French brandy, will turn the whole to a purple, or fine violet colour; and, by the ſtrength or paleneſs of this colour, the dealer judges the brandy genuine or mixed, in different proportions, with home ſpirits.

Old French brandy, having long lain in the caſk, takes a dilute tincture of the wood of the caſk, that is, of oak; and this, being of the ſame nature with a ſolution or tincture of galls, naturally turns bluiſh or blackiſh with vitriol. A new diſtilled brandy, though wholly foreign, would not give this teſt; and a common malt-ſpirit, with oak chips infuſed in it, will turn as dark as the fineſt brandy. While our diſtillers indeed had nothing in uſe for the colouring their ſpirits but burnt ſugar, it was poſſible to make ſome gueſs at an adulteration with them, becauſe the brandy, in this caſe, would not become blackiſh in proportion to its former colour, the ſugar-colour not turning to ink with the vitriol like the other; but our diſtillers have of late found a way of uſing an extract of oak for the colouring of their ſpirits, and, ſince that, this teſt liquor is of very little uſe, our common ſpirits, of any kind, turning as deep with it as the foreign brandies.

The very beſt way of making this teſt liquor is with a calcined vitriol of iron, diſſolved in a dilute or aqueous mineral acid. The liquor, when well made in this manner, is of a fine yellow colour, and will give, for a time, the fineſt blue to any ſpirituous tincture of oak.

The Engliſh were, at one time, very fond of high-coloured brandies, and it was then that the uſe of this teſt liquor was moſt eſteemed; afterwards we, as well as other nations, finding that this colour was only owing to the caſk, began to diſlike it, and to favour the pale brandies; at length we fell into the uſe of ſuch as were wholly limpid and colourleſs, and the rediſtilling of all the old brandies people were poſſeſſed of took place; on this, the teſt liquor was found to be of no uſe at all, and accordingly rejected; but as we are of late again come into the eſteem of coloured brandies, and that with great juſtice, as the colour, when genuine, is a certain mark of the age of the liquor, this teſt liquor is again got into more credit than it deſerves.

TES

The famous Helvetian ſtyptic depended wholly on this accident for its colour; and it was no ſmall mortification to our chemiſts, when, ſome years ago, it was introduced into uſe among us, that they could not make it with our own ſpirits, but muſt be at the expence of true French brandy for it; our own ſpirits, though equally coloured, would never make that violet tincture, becauſe their colour was owing to burnt ſugar, not a tincture of oak. At length this myſtery was explained, and a little ſcrapings of galls made all thoſe quantities of this ſtyptic, which had been ſet by as good for nothing, perfectly fine, and well coloured. *Shaw's Eſſay on Diſtillery.*

TEST-ACT, a ſtatute 25 Car. II. cap. 2. which requires all officers, both civil and military, to take the oaths and teſt, viz. the ſacrament, according to the rites and ceremonies of the Church of England; for the neglect whereof, a perſon executing any office, mentioned in that ſtatute, forfeits the ſum of 500 l. recoverable by action of debt.

TESTACEOUS, in natural hiſtory, an epithet given to a ſpecies of fiſh, which are covered with a ſtrong thick ſhell, as tortoiſes, oyſters, pearl-fiſh, &c.

In ſtrictneſs, however, teſtaceous is only applied to fiſh whoſe ſtrong and thick ſhells are entire and of a piece: thoſe which are ſoft, thin, and conſiſt of ſeveral pieces jointed, as the lobſter, &c. being called cruſtaceous.

But, in medicine, all preparations of ſhells and ſubſtances of the like kind, are called teſtaceous powders: ſuch are powder of crab's claws and eyes, hartſhorn, pearl, &c. Dr. Quincy and others ſuppoſe the virtue of all teſtaceous medicines to be alike; that they ſeldom or never enter into the lacteals, but that the chief of their action is in the firſt paſſages; in which caſe they are of great uſe in abſorbing acidities.

Hence they become of uſe in fevers, and eſpecially in rectifying the many diſtempers in children, which generally owe their origin to ſuch acidities.

TESTAMENT, *Teſtamentum*, in law, a ſolemn and authentic act whereby a perſon declares his will, as to the diſpoſal of his eſtate, effects, burial, &c.

The word is formed from the Latin *teſtamentum*, which the lawyers uſually derive from *teſtatio mentis*.

TESTATOR, or TESTATRIX, the perſon who makes his or her will and teſtament.

TESTES, in anatomy, two white, ſoft, oval bodies ſerving for generation; uſually called diminutively, teſticles.

TESTES *of the Brain*, are two little, round, hard bodies between the third and fourth ventricle, near the pineal gland. See BRAIN.

TESTICLE, *Teſtis*, in anatomy, a double part in male animals, ſerving for generation. See the article GENERATION.

The teſticles are two in number, of an oval or egg-like figure, and are contained in a peculiar bag, called the ſcrotum.

But beſides this external covering, the teſticles themſelves have their coats or tunics; the firſt of which compoſes the cremaſter-muſcle, the office of which is to raiſe the teſticle; the ſecond is the vaginalis tunica, formed of a proceſs of the peritonæum, and laxly ſurrounds the teſticle; the third is the tunica albuginea, which is robuſt and ſtrong, and adheres cloſely to the ſubſtance of the teſticle: this laſt receives the ſpermatic veſſels, and conveys them to the teſticle.

The ſubſtance of the teſticles is vaſculous, being compoſed of a great number of extremely minute veſſels, called vaſcula ſeminalia; which are convoluted together in the manner of the inteſtines, and appear beautifully after macerating the teſticles in vinegar. There is alſo a body, called, from the diſcoverer, corpus Highmori, wherein there is a cavity for the reception of the ſemen: this, in human ſubjects, is placed in the back of the teſticle; but in dogs, and many other animals, it is in the middle of the teſticle.

The veſſels of the teſticles are otherwiſe called ſpermatics. As to the uſe of the teſticles, it is to produce the ſemen maſculinum, for the purpoſe of generation.

Some alſo give the name of female teſticles, teſtes muliebres, to the ovaries of women.

Tumours of the TESTICLES. When theſe happen from any external injury, the beſt applications to diſperſe them, ſays Heiſter, are vinegar of litharge, lime-water, ſpirit of wine camphorated, and ceruſe, tutty, or lapis calaminaris mixed in it; but in the night-time, when the applications of fomentations are not ſo convenient, a plaſter of the mercurial kind, doubly ſated with mercury; or, in ſlight caſes, one of ſimple diachylon, may very properly be kept on. Internal medicines, ſuch as nitre, and the thin decoctions of diſcutient medicines, are alſo to be uſed; and, if occaſion call for it, bleeding in the arm is very proper.

This may be the method with tumours of theſe parts, from external injuries; but when they are from venereal cauſes, it is always neceſſary to give briſk purges, with the addition of a proper doſe of calomel to each; and warm and weak drinks ſhould be taken frequently, by which means theſe tumours are often diſperſed.

But if either remedies are applied too late, or the inflammation is too violent, the tumour generally ends either in a ſuppuration or gangrene. In this caſe the maturating remedies are to be applied, ſuch as warm cataplaſms and the like; and if the tumour does not break of itſelf at a proper time, from the application of theſe, it muſt be carefully opened with the knife, and the matter being diſcharged, the wound is to be cleanſed by injecting vulnerary decoctions, and afterwards healed with balſam of Peru, or the like.

TESTICULATED, among botaniſts, an appellation given to roots compoſed of two tuberoſe knobs, reſembling teſticles: ſuch are thoſe of orchis, &c.

TESTIMONIAL, a kind of certificate, ſigned either by the maſter and a fellow of the college where the perſon laſt reſided; or by three, at leaſt, reverend divines, who knew him well for three years laſt paſt, giving an account of the virtues, uniformity, and learning of the perſon.

Teſtimonial is alſo a certificate, under the hand of a juſtice of peace, teſtifying the place and time when a ſoldier or mariner landed, and the place of his dwelling, &c. whither he is to paſs.

There is alſo another kind of teſtimonial for the clergy, made by perſons preſent, that a clergyman has in all things complied with the act of uniformity; and to certify, that the clerk has performed what the law requires on his inſtitution and induction.

TESTIMONY, the ſame with evidence.

TESTUDO, in zoology, a genus of amphibious animals, with four legs and a tail, and the body covered with a firm ſhell.

This genus comprehends all thoſe animals known in Engliſh by the names of tortoiſes and turtles; of which there are a great many ſpecies, ſome with four toes on each foot, others with five toes on the fore feet, and four on the hinder ones; and others, diſtinguiſhed by other peculiarities, particularly the compartments of their ſhells, ſome being divided into irregular ſpaces, and others beautifully teſſelated.

The ſhells of theſe animals are much uſed in ornamental works, under the name of tortoiſe ſhells.

The turtle, whoſe fleſh is ſo finely flavoured, and ſo much eſteemed at table, is caught in great abundance in the American ſeas; and grows to a vaſt ſize, ſome having been found to weigh 480 pounds.

The Americans find ſo good account in catching turtle, that they have made themſelves very expert at it: they watch them from their neſts on ſhore, in moonlight nights; and, before they reach the ſea, turn them on their backs, and leave them till morning; when they are ſure to find them, ſince they are utterly unable to recover their former poſture: at other times they hunt them in boats, with a peculiar kind of ſpear, ſtriking them with it through the ſhell; and as there is a cord faſtened to the ſpear, they are taken much in the ſame manner as the whales.

TESTUDO, in antiquity, was particularly uſed among the poets, &c. for the ancient lyre; by reaſon it was originally made by its inventor, Mercury, of the black or hollow ſhell of the teſtudo aquatica, or ſea-tortoiſe, which he accidentally found on the banks of the river Nile.

TESTUDO, in the military art of the ancients, was a kind of cover or ſcreen which the ſoldiers, e. gr. a whole company, made themſelves of their bucklers, by holding them up over their heads, and ſtanding cloſe to each other. This expedient ſerved to ſhelter them from darts, ſtones, &c. thrown upon them, eſpecially thoſe thrown from above, when they went to the aſſault.

TESTUDO was alſo a kind of large wooden tower which moved on ſeveral wheels, and was covered with bullocks-hides flayed, ſerving to ſhelter the ſoldiers when they approached the walls to mine them, or to batter them with rams.

It was called teſtudo, from the ſtrength of its roof, which covered the workmen as the ſhell does the tortoiſe.

TESTUDO *veliformis quadrabilis*, a hemiſpherical vault, or ceiling of a church, wherein four windows are ſo contrived, as that the reſt of the vault is quadrable, or may be ſquared.

The determining of thoſe windows was a problem propoſed to the great mathematicians in Europe, particularly the cultivators of the new calculus differentialis in the Acta Eruditorum Lipſiæ, by Sig. Niviani, under the fictitious name of A. D. pio liſci puſillo geometra, which was the anagram of poſtremo Galilæi diſcipulo.

It was ſolved by ſeveral perſons, particularly Mr. Leibnitz, the very day he ſaw it: and he gave it in the Leipſic Acts in an infinity of manners; as alſo did M. Bernouilli, the marquis de l'Hoſpital, Dr. Wallis, and Dr. Gregory.

TETANUS, in medicine, is a convulſive motion that makes any part rigid and inflexible. See CONVULSION.

TETRACHORD, in the ancient muſic, a concord conſiſting of three degrees, tones, or intervals, or four ſounds, or terms; called alſo by the ancients διατεσσαρον, and by the moderns a fourth.

This interval had the name tetrachord given it, with reſpect to the lyre and its chords or ſtrings.

TETRADECARHOMBIS, in natural hiſtory, the name of a genus of foſſils, of the claſs of the ſelenitæ, expreſſing a rhomboidal body, conſiſting of fourteen planes.

The characters of this genus are, that the bodies of it are exactly of the ſame form with the common ſelenitæ; but that in theſe each of the end-planes is divided into two, and there are, by this means, eight of theſe planes inſtead of four. Of this genus there are only three known ſpecies. 1. A thin, pellucid one, with tranſverſe filaments, which is frequent in the clay pits of Northamptonſhire, and ſome other counties. 2. A dull, thicker kind, with very ſlender, tranſverſe filaments: this is a very rare ſpecies, and found, as far as is yet known, only in Leiceſterſhire in the yellow brick clay, and at ſmall depths. And, 3. A large ſcaly kind, conſiderably long, and of a very rough ſurface: this is found in Yorkſhire, and that ſometimes looſe, on the ſides of the hills, but more frequently buried in the ſtrata of clay.

TETRADIAPASON, a muſical chord, otherwiſe called a quadruple diapaſon, or eighth.

TETRADITÆ, a name given to ſeveral different ſects of heretics. The Sabbathians were called tetraditæ, from their keeping Eaſter-day on the fourth day, or on Wedneſday. The Manichees, and others who admitted of a quaternity inſtead of a trinity in the Godhead, were alſo called tetraditæ. The followers of Petrus Fullenſis had the ſame appellation, by reaſon of the addition they made to the triſagion, to ſupport an error they held, that in our Saviour's paſſion it was not any particular perſon of the Godhead that ſuffered, but the whole deity.

TETRADYNAMIA, in botany, a claſs of plants, whoſe flowers have four of their ſtamina of more efficacy than the reſt: theſe are always known by having the four efficacious ſtamina longer than the reſt.

The tetradynamia of Linnæus include thoſe called by

Tournefort cruciformes, and by Ray, ſiliquoſæ, and ſiliculoſæ.

The general characters of which are theſe: the perianthium is of an oblong figure, and is compoſed of four leaves, which are oval, oblong, hollow, obtuſe, and converging toward one another, and are gibbous at the baſe: theſe all fall off with the flower, and ſtand in pairs; the oppoſite ones being always equal in length, this cup is properly the nectarium of the plant, and it is on this occaſion that it is gibbous at the baſe. The flower is of that kind called by Tournefort, cruciform; it conſiſts of four equal petals, which have ungues of the length of the cup, erect, and flat; the petals are broad at the top, and obtuſe, and ſcarce touch one another at the ſides; and the inſertion of the petals and of the ſtamina is in the ſame place.

The ſtamina are ſix ſubulated erect filaments, the two oppoſite ones are of the length of the cup, the other four are ſomething longer, and are of a leſs length however than the petals. The antheræ are oblong and pointed, thick at the baſe and erect, with apices bending ſideways. The nectariferous gland in the different genera of this claſs, is differently ſituated. It uſually, however, is found near the ſtamina, and moſt frequently of all is affixed to ſome ſhort filaments, and ſtands near their baſe. Two of the ſtamina are often curved, that they may not preſs upon this gland; and it is often owing to this, that two are ſhorter than the reſt. The germen of the piſtil is placed above the receptacle, and is every day in its growth raiſed higher and higher. The ſtyle is ſometimes wanting, but in ſuch plants as have it, it is of the length of the longer ſtamina. The ſtigma is always obtuſe.

The fruit or capſule is always a bivalve pod, which often contains two cells; this, when ripe, opens by ſplitting from the apex to the baſe, and it has always a little membranous ſubſtance ſerving within as a ſeptem, when the pod is bilocular; this ſtands out beyond the apex, and is the rudiments of what was before the ſtyle. The ſeeds are roundiſh, and the pod uſually narrow and oblong.

This is a very natural claſs of plants, and has been received as ſuch under whatever name by all the ſyſtematical writers in botany: and the plants contained under it are generally ſuppoſed to be all antiſcorbutics.

It is naturally ſubdivided into two ſeries; the one containing the ſiliculoſe plants, and the other the ſiliquoſe: the firſt have a ſhort pod, the others a long and ſlender one: the firſt pods uſually have more of the remains of the ſtyle than the others.

TETRAEDRON, or TETRAHEDRON, in geometry, one of the five regular or platonic bodies or ſolids, comprehended under four equilateral and equal triangles.

It is demonſtrated by mathematicians, that the ſquare of the ſide of a tetraedron is to the ſquare of the diameter of a ſphere, wherein it may be inſcribed, in a ſubſequialteral ratio: whence it follows, that the ſide of a tetraedron is to the diameter of a ſphere it is inſcribed in, as $\sqrt{2}$ to the $\sqrt{3}$, conſequently they are incommenſurable.

TETRAGON, in geometry, a general name for any fourſided figure, as a ſquare, parallelogram, rhombus, or trapezium.

TETRAGON, in aſtrology, an aſpect of two planets with regard to the earth, more uſually called quartile.

TETRAGONIAS, a name given to a meteor, whoſe head is of a quadrangular figure, and its tail or train long, thick, and uniform.

TETRAGONISM, in geometry, a term uſed by ſome for the quadrature of a circle.

TETRAGONUS, in anatomy, a muſcle otherwiſe called quadratus genæ.

TETRAGRAMMATON, a denomination given by the Greeks to the Hebrew name of God, יהוה, Jehovah, becauſe conſiſting of four letters.

TETRAMETER, in ancient poetry, an iambic verſe, conſiſting of four meaſures, or eight feet. This kind of verſe is only found in the comic poets, as Terence, &c.

TETRANDRIA, in the Linnæan ſyſtem of botany, a claſs of plants, the fourth in order: comprehending all ſuch plants as have hermaphrodite flowers, with four ſtamina, or male parts in each. See BOTANY.

TETRAPETALOUS, in botany, an epithet given to flowers that conſiſt of four ſingle petala or leaves, placed around the piſtil.

TETRAPLA, in church hiſtory, an edition of the Old Teſtament, publiſhed by Origen, and ſo called, becauſe it contained the four different Greek verſions, namely, the Septuagint, and thoſe of Aquila, Symmachus, and Theodotion. They were placed in diſtinct columns, over againſt each other, in the ſame page: whence this book was called the tetrapla, or four-fold edition.

Origen beſtowed infinite labour on this work, which was finiſhed about the year 250. The original copy was depoſited in the library of the church of Cæſarea in Paleſtine, where St. Jerom many years after, conſulted, and tranſcribed it. The uſe and excellency of it being known, many copies of it were taken, and diſperſed to other churches. At length, about the ſeventh century, the inundations of the Saracens upon the eaſtern parts having deſtroyed all libraries, wherever they came, it was after this never more heard of. However, this deſign of Origen's gave birth to Polyglots in after ages.

TETRAPTERA, in the hiſtory of inſects, a name given to that order of inſects, which have four wings.

The inſects of this order are very numerous, and have certain evident diſtinctions in the ſtructure of their wings, and are thence arranged under five claſſes; viz. the coleoptera, ſcleroptera, neuroptera, lipidoptera, and hyrnenoptera.

TETRAPTOTE, *tetraptoton*, in grammar, a name given to ſuch defective nouns as have only four caſes; ſuch are *viſcis*, *pecudis*, *ſordis*, &c. as being deprived of the nominative and vocative ſingular.

TETRAPYRAMIDIA, in natural hiſtory, the name of a genus of ſpars, influenced in their ſhape by an admixture of particles of tin, and found in form of broad-bottomed pyramids of four ſides.

Of this genus there is only one known ſpecies, which is uſually of a browniſh colour, and found in Saxony, as alſo in Devonſhire, Cornwall, and other counties of England, where there is tin.

TETRARCH, *Tetrarcha*, a prince who holds and governs a fourth part of a kingdom. Such originally was the import of the title tetrarch; but it was afterwards applied to any petty king or ſovereign, and became ſynonymous with ethnarch.

TETRASTICH, a ſtanza, epigram, or poem, conſiſting of four verſes.

TETRASTYLE, in the ancient architecture, a building, and particularly a temple, with four columns in its front.

TETRASYLLABICAL, a word conſiſting of four ſyllables.

TETRATONON, in muſic, a name whereby the ſuperfluous fifth is ſometimes called, as containing four tones.

TEUCRIUM, in botany, a genus of plants, the corolla of which is ringent, and formed of a ſingle petal: the tube is cylindric and ſhort, and terminates in an incurvated opening: the lower lip is divided into three ſegments; the lateral ones are of the figure of the upper lip, and ſomewhat erect; the middle one is much larger and rounded: there is no pericarpium; the ſeeds are four, roundiſh, and lodged in the baſe of the cup.

This genus comprehends the germander, polium, ſcordium, &c. This plant has the credit of being a great ſudorific and alexipharmic. It is preſcribed in malignant and peſtilential fevers, and in the plague itſelf, as alſo in obſtructions of the liver and ſpleen; it is ſaid to deſtroy worms externally; it cleanſes ulcers, and is applied by way of cataplaſm to mitigate pain; it is at preſent chiefly uſed in the ſhops as an ingredient in the confectio Fracaſtorii.

TEUTONIC, ſomething belonging to the Teutons, an ancient people of Germany, inhabiting chiefly along the

the coaſts of the German ocean; thus, the Teutonic language is the ancient language of Germany, which is ranked among the mother tongues. The Teutonic is now called the German or Dutch, and is diſtinguiſhed into upper and lower. The upper has two notable dialects, viz. 1. The Scandian, Daniſh, or perhaps Gothic; to which belong the languages ſpoken in Denmark, Norway, Sweden, and Iceland. 2. The Saxon, to which belong the ſeveral languages of the Engliſh, Scots, Friſian, and thoſe on the north of the Elbe. To the lower the Low Dutch, Flemiſh, &c. ſpoken through the Netherlands, &c.

TEUTONIC ORDER, a military order of knights, eſtabliſhed towards the cloſe of the twelfth century, and thus called as conſiſting chiefly of Germans or Teutons.

The origin, &c. of the Teutonic order is ſaid to be this. The Chriſtians under Guy of Luſignan, laying ſiege to Acre, or Acon, a city of Syria, on the borders of the Holy Land, ſome Germans of Bremen and Lubec, touched with compaſſion for the ſick and wounded of the army, who wanted common neceſſaries, ſet on foot a kind of hoſpital under a tent, which they made of a ſhip's ſail, and here betook themſelves to a charitable attendance on them. This ſtarted a thought of eſtabliſhing a third military order, in imitation of the Templars and Hoſpitallers. The deſign was approved of by the patriarch of Jeruſalem, the archbiſhop of the neighbouring places, the king of Jeruſalem, the maſters of the temple and hoſpital, and the German lords and prelates then in the Holy Land, and pope Calixtus III. confirmed it by his bull; and the new order was called the order of Teutonic Knights of the houſe of St. Mary at Jeruſalem. The pope granted them all the privileges of the Templars and Hoſpitallers of St. John, excepting that they were to be ſubject to the patriarchs and other prelates, and that they ſhould pay tythe of what they poſſeſſed.

Others relate, that the Teutonic order was eſtabliſhed at Jeruſalem, before the city of Acre was beſieged.

The officers of the Teutonic order, while in its ſplendor, were the grand maſter, who reſided at Marienburg; under him were the grand commander; the grand marſhal, who had his reſidence at Koningſberg; the grand hoſpitaller, who reſided at Elbing; the draper, who took care to furniſh the habits; the treaſurer, who lived at the court of the grand maſter; and ſeveral commanders, as thoſe of Thorne, Culme, Brandenburg, Koningſberg, Elbing, &c. They had alſo their commanders of particular caſtles and fortreſſes, advocates, proveditors, intendants of mills, proviſions, &c.

This order is now little more than the ſhadow of what it formerly was, having only three or four commanderies, ſcarce ſufficient for the ordinary ſubſiſtence of the grand maſter and his knights.

TEXT, a relative term, contradiſtinguiſhed to gloſs or commentary, and ſignifying an original diſcourſe excluſive of any note or interpretation. This word is particularly uſed for a certain paſſage of ſcripture, choſen by a preacher to be the ſubject of his ſermon.

A text-book, in ſeveral univerſities, is a claſſic author written very wide by the ſtudents, to give room for an interpretation dictated by the maſter or regent to be inſerted in the interlines.

The Spaniards give the name of text to a kind of little poem or ſet of verſes placed at the head of a gloſs, and making the ſubject thereof, each verſe being explained one after another in the courſe of the gloſs.

Anciently the lawyers began all their pleadings with like texts of ſcripture.

TEXTURE, *Textura*, properly denotes the arrangement and coheſion of ſeveral ſlender bodies or threads interwoven or entangled among each other, as in the webs of ſpiders, or in cloths, ſtuffs, &c.

Texture is alſo uſed in ſpeaking of any union or conſtituent particles of a concrete body, whether by weaving, hooking, knitting, tying, chaining, indenting, intruding, compreſſing, attracting, or any other way. In which ſenſe we ſay a cloſe compact texture, a lax porous texture, a regular or irregular texture, &c. A great deal depends on the texture of the component parts of a body; hence moſt of its particular properties, its ſpecific gravity, colour, &c.

THALAMI *Nervorum Opticorum*, in anatomy, two oblong prominences of the lateral ventricles of the brain, medullary without, but a little cineritious within, being thus called becauſe the optic nerves riſe out of them.

THANE, or THAIN, *Thanus*, a name of an ancient dignity among the Engliſh and Scots, or Anglo-Saxons. Skene makes thane to be a dignity equal to the ſon of an earl. Camden will have it, that thanes were only dignified by the offices they bore. There were two kinds or orders of thanes, the king's thanes, and the ordinary thanes: the firſt were thoſe who attended the king in his courts, and who held lands immediately of the king. The ordinary thanes, or the Thaniminores, were the lords of the manors, who had particular juriſdiction within their limits, and over their own tenants; theſe changed their names for that of barons, and hence their courts are called courts-baron to this day.

THANE-LANDS, were lands granted by charters of our ancient kings to their thanes, with all immunities, except the threefold neceſſity of expedition, repair of caſtles, and mending bridges.

THAPSIA, Deadly Carrot, in botany, a genus of plants, the general corolla of which is uniform: the ſingle flowers conſiſt each of five crooked, lanceolated petals: the fruit is naked, oblong, ſurrounded longitudinally with a membrane, and ſeparable into two parts: the ſeeds are two, large, oblong, and convex, pointed at each end; and having on each ſide a plane margin, large and undivided, which is emarginated at top and bottom.

This plant is uſed to provoke the menſes, and other evacuations, and externally it is uſed in ointments for the itch, and the like cutaneous diſorders.

THAUMATURGUS, a worker of miracles, an appellation which the Romaniſts give to ſeveral of their ſaints eminent for the number and greatneſs of their miracles.

THAWING, the reſolution of ice into its former fluid ſtate, by the warmth of the air, &c.

Boerhaave obſerves, that if a ſudden thaw takes place after a long ſharp froſt, which has bound up the rivers, and penetrated the earth's ſurface to a conſiderable depth, it is, uſually, quickly ſucceeded by a multitude of clouds and uncommon heats, and then by thunder and lightening. The reaſon is, that the fat vapours and exhalations raiſed by the ſubterraneous heat, have long remained impriſoned under that covering of the earth; as appears hence, that if the ice of a ditch be broke in the middle of a ſevere froſt, it preſently emits warm vapours, and this the more plentifully, as well as the hotter, by how much the froſt is harder and the ice thicker. As ſoon, therefore, as the exterior frozen turf of earth is ſoftened by warmth, the pent-up vapours immediately eſcape through all the paſſages they can find, and mounting on high, form clouds, which being driven about, and ſometimes illumined by the ſun, produce ſuch effects. Hence the violent thunders in Muſcovy, Sweden, and Denmark, after a thaw.

THEATINES, an order of nuns, under the direction of the Theatins.

There are two kinds of Theatines, under the title of Siſters of the Immaculate Conception, who form two different congregations, the one engaged by ſolemn vows, and the other only by ſimple vows. Their common foundreſs was Urſula Benincaſa. Thoſe who make the ſimple vows are the moſt ancient, and are called abſolutely Theatines of the congregation: they had their riſe at Naples, in 1583.

The others are called Theatines of the hermitage: the whole buſineſs of theſe is praying in retirement, and an auſtere ſolitude, to which they engage themſelves by ſolemn vows.

The Theatines of the firſt congregation take care of the temporal concerns of theſe laſt. Their houſes ſtand together, and communicate by a large hall. Their foundreſs drew up their conſtitutions, and laid the foundation of their houſe at Naples, but died before it was finiſhed.

Gregory the XVth, who confirmed the new inſtitute under the rule of St. Auguſtin, appointed that they ſhould be under the direction of the Theatins. Urban VIII. revoked this article by a brief in 1624, and ſubjected them to the nuncio of Naples: but Clement IX. annulled this brief, and ſubmittted them anew to the Theatins by a brief in 1668.

THEATINS, a religious order of regular prieſts, thus called from their firſt ſuperior Don John Pietro Caraffa, archbiſhop of Chieſi, in the kingdom of Naples, which was anciently called Theate.

The ſame archbiſhop was afterwards pope, by the name of Paul IV. after having been a companion of Gaëtan, a Venetian gentleman, the firſt founder of this order, at Rome, in 1524.

The Theatins were the firſt who aſſumed the title of regular clerks. They have not only no lands, or fixed revenues, either in common or in propriety; but they do not even aſk or beg any thing; but wait for what Providence ſhall ſend them for their ſubſiſtence.

They employed themſelves much in foreign miſſions; and in 1627 entered upon Mingrelia, where they have an eſtabliſhment: they have had the like in Tartary, Circaſſia, and Georgia, which they have ſince abandoned, by reaſon of the little fruit they perceived thereof.

Their firſt congregation appeared at Rome in 1524, and was confirmed the ſame year by Clement VII.—Their conſtitutions were drawn up at a general chapter in 1604, and approved by Clement VIII. They wear the prieſts habit.

THEATRE, θεατρον, in antiquity, a public edifice for the exhibiting of ſcenic ſpectacles, or ſhews, to the people; comprehending not only the eminence on which the actors appeared, and the action paſſed, but alſo the whole area of the place, common to the actors and ſpectators.

The Romans borrowed the form of their theatres from thoſe of the Greeks, which were generally built in the ſhape of a ſemi-circle, encompaſſed with porticos, and furniſhed with ſeats of ſtone, diſpoſed in ſemi-circles, riſing gradually one above another.

The principal parts of the antient theatres were the ſcena, proſcenium, orcheſtra, and area.

Among the moderns, theatre more peculiarly denotes the ſtage, or place whereon the drama or play is exhibited; anſwering to the proſcenium of the antients. It is alſo uſed, in a more comprehenſive ſenſe, for the whole play-houſe.

THEATRE is alſo uſed in architecture, chiefly among the Italians, for an aſſemblage of ſeveral buildings, which, by a happy diſpoſition and elevation, repreſents an agreeable ſcene to the eye.

Anatomical THEATRE, in a ſchool of medicine and chirurgery, is a hall, with ſeveral rows of ſeats, diſpoſed in the circumference of an amphitheatre; having a table bearing on a pivot, in the middle, for the diſſection of bodies.

THEBAID, *Thebais*, a celebrated heroic poem of Statius, the ſubject whereof is the civil war of Thebes, between the two brothers Eteocles and Polynices; or, Thebes taken by Theſeus.

The Thebaid is cenſured by the beſt of critics, for a multiplicity of fables and actions; for too much heat and extravagance, and for going beyond the bounds of probability.

THEFT, *furtum*, in law, an unlawful felonious taking away another man's moveable and perſonal goods, againſt the owner's will, with intent to ſteal them.

It is divided into theft or larceny, properly ſo called, and petit theft, or petit larceny; the former of which is of goods above the value of twelve-pence, and is deemed felony: the other, which is of goods under that value, is not felony.

THEFTBOTE, the receiving a man's goods again from a thief or other amends, by way of compoſition, and to prevent proſecutions, that the felon may eſcape unpuniſhed; the puniſhment of which is impriſonment, but not the loſs of life or members.

THELONIUM, in law-books, is uſed to denote any kind of toll: hence, citizens and other perſons who have a right to be free from toll, may have a writ called breve eſſendi quieti de thelonio.

THEME, in matters of education, denotes the ſubject of an exerciſe, for young ſtudents to write or compoſe on.

THEME, among aſtrologers, denotes the figure repreſenting the ſtate of the heavens for any time required; that is, the places of the ſtars and planets for that time.

THENAR, in anatomy, the abductor-muſcle of the thumb: it has its origin in the tranſverſe ligament that joins the bones of the carpus, and its termination in the firſt and ſecond phalanx: the two ſeſambide bones of the thumb are uſually found lodged in the tendon of this muſcle.

The abductor-muſcle of the great toe, likewiſe called thenar, has its origin from the internal ſide of the calcaneum, and the os naviculare; and its termination at the internal ſide of the great toe, beſide the internal ſeſamoide bone.

THEOBROMA, in botany, a genus of plants; the empalement of the flower is compoſed of three oval concave leaves, which are reflexed. The flower has five oval petals, which ſpread open, and are hollowed like a ſpoon; from the top of each petal comes out a bifid briſtly ligula, divided like two horns. It has a great number of ſhort ſtamina joined in five bodies, which are terminated by roundiſh ſummits, and a roundiſh germen ſupporting a ſingle ſtyle the length of the petals, crowned by a ſingle ſtigma. The germen afteward turns to a roundiſh fruit with five angles, opening in five cells, each containing ſeveral ſeeds.

This tree grows naturally in moſt of the iſlands in the Weſt Indies, where it riſes to the height of forty or fifty feet, having a trunk as large as a middle-ſized man's body, covered with a dark brown furrowed bark, ſending out many branches toward the top, which ſpread wide on every hand, garniſhed with oblong heart-ſhaped leaves, placed alternate, of a bright green on their upper ſide, and pale on their under, ſawed on their edges, with a ſtrong midrib, and ſeveral tranſverſe veins, ſtanding upon ſhort foot-ſtalks. The flowers come out in bunches from the wings of the leaves; they are ſmall, of a yellow colour, having five concave petals, which ſpread open circularly, and a great number of ſtamina, which at their baſe are joined in five bodies, terminated by roundiſh ſummits. In the center is ſituated a roundiſh germen, ſupporting a ſlender ſtyle the length of the ſtamina, crowned by a ſingle ſtigma. The germen afterward turns to a roundiſh warted fruit, having five obtuſe angles, and five cells, which contain ſeveral irregular ſeeds.

The wood of this tree is white and ductile, ſo is frequently cut into ſtaves for caſks. The fruit and leaves are good fodder for cattle, therefore when the planters clear the land from wood, they leave the trees of this ſtanding for the ſeed, which is of great uſe in dry ſeaſons, when the common fodder is ſcarce.

There are ſome plants of this ſort in England preſerved in the gardens of curious perſons; it is propagated by ſeeds, which muſt be procured as freſh as poſſible, from the countries where the plants grow naturally. Theſe ſhould be ſown upon a good hot bed in the ſpring; and, when the plants are fit to remove, they ſhould be each planted in a ſeparate ſmall pot, and plunged into a hot bed of tanners bark, obſerving to ſhade them from the ſun till they have taken new root; then they ſhould be treated in the ſame way as the coffee-tree, keeping them always in the tan-bed in the ſtove.

THEOCRACY, θεοκρατεια, in matters of government, a ſtate governed by the immediate direction of God alone; ſuch was the antient government of the Jews, before the time of Saul.

THEODOLITE, a mathematical inſtrument much uſed in ſurveying, for the taking of angles, diſtances, &c.

It is made variouſly, ſeveral perſons having their ſeveral ways of contriving it, each more ſimple and portable, more accurate and expeditious than others. The common one conſiſts of a braſs-circle about a foot diameter,

meter, cut in the form repreſented in plate CXXVII. *fig.* 1. having its limb divided into 360 degrees, and each degree ſubdivided, either diagonally, or otherwiſe, into minutes.

Underneath, at *c c*, are fixed two little pillars *b b*, *fig.* 2. which ſupport an axis, whereupon is fixed a teleſcope conſiſting of two glaſſes, in a ſquare braſs tube, for the viewing of remote objects.

On the center of the circle moves the index C, which is a circular plate, having a compaſs in the middle whoſe meridian line anſwers to the fiducial line *a a:* at *b b*, are fixed two pillars to ſupport an axis which bears a teleſcope like the former, whoſe line of collimation anſwers to the fiducial line *a a*. At each end of either teleſcope, is fixed a plain ſight for the viewing nearer objects.

The ends of the index *a a* are cut circularly, to fit the diviſions of the limb B; and when that limb is diagonally divided, the fiducial line, at one end of the index, ſhews the degrees and minutes upon the limb. The whole inſtrument is mounted with a ball and ſocket, upon a three-legged ſtaff.

Moſt theodolites have no teleſcopes, but only four plain ſights, two of them faſtened on the limb, and two on the ends of the index.

Mr. Siſſon's improved theodolite being one of the beſt of theſe inſtruments, we ſhall here give its deſcription, *fig.* 3. The three ſtaves, whereby it is ſupported, ſcrew into bell-metal joints by braſs ferrils at top, which are moveable between braſs pillars fixed in a ſtrong braſs plate; in which, round the center, is fixed a ſocket with a ball moveable in it, and upon which the four ſcrews preſs that ſet the limb horizontal. Next above is ſuch another plate, through which the ſaid ſcrews paſs, and on which round the center is fixed a fruſtum of a cone of bell-metal, whoſe axis, being connected with the center of the ball, is always perpendicular to the limb, by means of a conical braſs ferril fitted to it, whereon is fixed the compaſs-box, and on it the limb, which is a ſtong bell-metal ring, whereon are moveable three braſs indexes, in whoſe plate are fixed four braſs pillars, that joining at top, hold the center-pin of the bell-metal double ſextant, whoſe double index is fixed in the center of the ſame plate. Within the double ſextant is fixed the ſpirit-level, and over it the teleſcope.

The compaſs-box is graved with two diamonds for north and ſouth, and with 20 degrees on both ſides of each, that the needle may be ſet to the variation, and its error alſo known.

The limb has two fleur-de-luces againſt the diamonds in the box, and is curiouſly divided into whole degrees, and numbered to the left hand at every 10° to twice 180°, having three indexes, with Nonius's diviſions on each for the decimals of a degree, that are moved by a pinion fixed below one of them without moving the limb, and in another is a ſcrew and ſpring under, to fix it to any part of the limb: it has alſo diviſions numbered for taking the quarter girt in round timber; to which a ſhorter index is uſed, having Nonius's diviſions for the decimals of an inch; but an abatement muſt be made for the bark, if not taken off.

The double ſextant is divided on one ſide from under its center, when the ſpirit-tube and teleſcope are level, to above 60 degrees each way, and numbered at 10, 20, &c. And the double index, through which it is moveable, ſhews on the ſame ſide the degree and decimal of any altitude, or depreſſion to that extent, by Nonius's diviſions; on the other ſide are diviſions numbered for taking the upright height of timber, &c. in feet, when diſtant ten feet, which at 20 muſt be doubled, and at 30 trebled; and alſo the quantities for reducing hypothenuſal lines to horizontal: it is moveable by a pinion fixed in the double index.

The teleſcope is a little ſhorter than the diameter of the limb, that a fall may not hurt it; yet it will magnify as much, and ſhew a diſtinct object as perfect, as moſt of treble its length: in its focus are very fine croſs wires, whoſe interſection is in the plane of the double ſextant, and this is a whole circle, and turned in a lathe to a true plane, and is fixed at right angles to the limb; ſo that whenever the limb is ſet horizontal, which is readily done by making the ſpirit-tube level over two ſcrews, and the like over the other two, the double ſextant and teleſcope are moveable in a vertical plane, and then every angle taken on the limb, though the teleſcope be never ſo much elevated or depreſſed, will be an angle in the plane of the horizon; and this is abſolutely neceſſary in plotting an horizontal plane.

The uſe of the theodolite is abundantly ſhewn in that of the graphometer, or ſemi-circle, which is only half a theodolite; and in that of the plain table, which is occaſionally made to be uſed as a theodolite. Note, the index and compaſs of a theodolite, likewiſe ſerve for a circumferentor, and are uſed as ſuch.

THEOGONY, that branch of the heathen theology, which taught the genealogy of their gods.

THEOLOGIUM, in the ancient theatre, a kind of little ſtage, above that whereon the ordinary actors appeared; being the place where the machinery of the gods were diſpoſed; whence the name.

THEOLOGY, or DIVINITY, a ſcience which inſtructs us in the knowledge of God, or divine things; or which has God, and the things he has revealed, for its object.

Hence theology may be diſtinguiſhed into natural, which comprehends the knowledge we have of God from his works, by the light of reaſon alone; and ſupernatural, which contains what we are taught concerning God in revelation.

Theology is again diſtinguiſhed into poſitive, moral, and ſcholaſtic. Poſitive knowledge is the knowledge of the Holy Scriptures, and of the ſignification thereof, conformably to the opinions of the fathers and councils, without the aſſiſtance of any argumentation. Some will have it, that this ought to be called expoſitive rather than poſitive. Moral theology, is that which teaches us the divine laws relating to our manners and actions. Scholaſtic, or ſchool theology, is that which proceeds by reaſoning; or that derives the knowledge of ſeveral divine things from certain eſtabliſhed principles of faith.

THEORBA, THIORBA, or TIORBA, a muſical inſtrument made in form of a large lute, except that it has two necks or juga, the ſecond and longer of which ſuſtains the four laſt rows of chords which are to give the deepeſt ſounds.

THEOREM, a ſpeculative propoſition, demonſtrating the properties of any ſubject. Theorems are either univerſal, which extend to any quantity, without reſtriction univerſally; as this, that the rectangle of the ſum and difference of any two quantities, is equal to the difference of their ſquares: or particular, which extend only to a particular quantity; as this, in an equilateral right-lined triangle, each of the angles is 60 degrees.

Theorems are again diſtinguiſhed into negative, local, plane, and ſolid.

A negative theorem is that which expreſſes the impoſſibility of any aſſertion; as that the ſum of two biquadrate numbers cannot make a ſquare number. A local theorem is that which relates to a ſurface; as, that the triangles of the ſame baſe and altitude are equal. A plane theorem is that which either relates to a rectilinear ſurface, or to one terminated by the circumference of a circle; as that all angles in the ſame ſegment of a circle are equal. And a ſolid theorem is that which conſiders a ſpace terminated by a ſolid line; that is, by any of the three conic ſections, e. gr. this: that if a right line cut two aſymptotic parabola's, its two parts terminated by them ſhall be equal.

Reciprocal THEOREM, is one whoſe converſe is true; as that, if a triangle have two equal ſides, it muſt have two equal angles; the converſe of which is likewiſe true, that, if it have two equal angles, it muſt have two equal ſides.

THEORETIC, or THEORETICAL, ſomething relating to theory, or that terminates in ſpeculation.

Hence theoretical aſtronomy is that part of aſtronomy, which accounts for the various phænomena of the ſtars and planets.

THEORY, in general, denotes any doctrine which terminates in ſpeculation alone, without conſidering the practical uſes and application thereof. Thus the theory of chemiſtry, for inſtance, contains all the general truths

which the particular experiments of chemists have hitherto demonstrated. These are, on this occasion, to be taken for granted, and the whole body of such truths makes the universal theory of chymistry, for chemistry is no science formed *à priori*; it is no production of the human mind, or raised by reasoning, but collected *a posteriori* from experiments: it took its rise from various operations casually made, and observing those that had one and the same uniform tendency, without any expectation of what followed; and was only reduced into an art, by collecting and comparing the effects of such uncertain experiments, and noting the tendency thereof: so far then as a number of experiments agree to establish any unquestionable truth; so far they may be considered as constituting the theory of chemistry.

Such a theory is necessary to be premised to every art; and something equivalent to this is practised by every artisan, in teaching his disciple how to proceed orderly in the exercise of his art; and accordingly it would be impossible to teach the practice of chymistry to advantage, without having first given some such theory. Thus it would be to little purpose to give a novice a parcel of rosemary, for instance, and bid him, without any addition, distil a water from it, which should contain the natural taste and odour of the plant; unless he knew before-hand this general truth, that plants, exposed to a gentle heat, like that of the summer's sun, do exhale their most subtle and volatile parts, which, being collected and condensed by means of proper vessels, appear in form of water, and are the thing required.

THERAPEUTÆ, a term applied to those who are wholly employed in the service of religion. This general term has been applied to particular sects of men, concerning whom there have been great disputes among the learned.

It is generally supposed that St. Mark established a particular society of Christians about Alexandria, of whom Philo gives an account, and calls them Therapeutæ. He speaks of them as a particular sect, retired from the world, who spent their time in reading the writings of ancient authors, in singing hymns and songs composed by some of their own sect, and in dancing together the whole night. Scaliger maintains, they were Essene Jews; but Valesius rejects this opinion of Scaliger, 1. Because Philo never calls them Essenes. 2. Because there were no Essenes but in the Holy Land; whereas the Therapeutæ were spread through Greece, and all the barbarous nations. 3. Because Josephus, who gives a very ample account of the Essenes, does not say one word of the Therapeutæ.

THERAPEUTICE, THERAPEUTICS, that part of medicine which acquaints us with the rules that are to be observed, and the medicines to be employed in the cure of diseases.

THERAPHIM, or TERAPHIM, certain images, or superstitious figures mentioned in scripture.

We meet with this word thirteen or fourteen times in scripture, where it is commonly interpreted idols: but the rabbins are not contented to have it simply signify idols, but will have it denote a peculiar sort of idols or images for the knowledge of futurity, i. e. oracles.

R. David de Pomis observes, that they were called theraphim, from רפה, raphah, to leave, because people quitted every thing to consult them. —He adds, that the theraphim were in human shape; and that, when raised upright, they spoke at certain hours, and under certain constellations, by the influence of the celestial bodies. This is a rabbinical fable, which he has learned from Abenezra.

Others hold, that the theraphim were brazen instruments which pointed out the hours and minutes of future events, as directed by the stars. —De Pomis corrects Abenezra, saying, that the theraphim being made under a certain constellation, the devil made them speak under the same.

R. Eliezer tells us the reason why the rabbins will have the theraphim to speak, and render oracles: it is, says he, because it is written, in the prophet Zachary, x. 2. "The theraphim have spoken vain things."

The same rabbin adds, that, to make the theraphim, they killed a first-born child, clove his head, and seasoned it with salt and oil; that they wrote on a plate of gold the name of some impure spirit, laid it under the tongue of the dead, placed the head against the wall, lighted lamps before it, prayed to it, and it talked with them.

Be this as it will, Vorstius observes, that, besides the passage of Zachary just quoted, it appears likewise from Ezekiel xxi. 22, that the theraphim were consulted as oracles.

De Pomis endeavours to shew, that the theraphim, which Michal put in David's bed, were not of this kind, because they were not in the figure of men: but R. Eliezer is of another sentiment.

As to the manner of making the theraphim, Vorstius takes it to be a vain tradition of the rabbins, though R. Tanchuma and Jonathan, in his Targum, Gen. xxxi. 19, relate it after R. Eliezer. —The chief reason of his disbelief is, that Laban, who had not quite lost all notion of the true God, as appears from Gen. xxxi. 53, could not be guilty of so great a cruelty: but Vorstius does not consider, that the custom might not be less real, for its not having been established so early as Laban: and that the Hebrews sometimes burnt their children to Moloch.

F. Kircher directs us to seek the origin of the theraphim in Egypt; adding, that the word is Egyptian. —Spencer, in his dissertation on the Urim and Thummim, maintains the word to be Chaldee, and to signify the same with seraphim, the Chaldeans being frequently known to change the ש into ת, that is, *s* into *t*. He adds, that those images were borrowed from the Amorites, Chaldeans, or Syrians; and that the Serapis of the Egyptians is the same thing with the theraphim of the Chaldeans. See *Selden de Diis Syriis, synt.* 1. c. 2.

THERIACA, ANDROMACHI, a compound medicine, made in the form of an electuary, the ingredients of which, according to the college of London physicians, are as follows: Take of the troches of squills, half a pound; long pepper, opium strained, dried vipers, of each three ounces; cinnamon, balsam of Gilead, or in its stead expressed oil of nutmeg, of each two ounces: agaric, the root of Florentine orrice, water germander, red roses, seeds of navew, extract of liquorice, of each an ounce and a half; spikenard, saffron, amomum, myrrh, costus, or in its place zedoary, camels hay, of each an ounce; the root of cinquefoil, rhubarb, ginger, Indian leaf, or in its room mace, leaves of dittany of Crete, of hore-hound, and of calamint, French lavender, black pepper, seeds of Macedonian parsley, olibanum, Chio turpentine, root of wild valerian, of each six drams; gentian root, Celtic nard, spignel, leaves of poley-mountain, of St. John's wort, of ground pine, tops of creeping germander, with the seed, the fruit of the balsam-tree, or in its stead cubebs, aniseed, the lesser cardamom seeds husked, seeds of bishop's weed, of hartwort, of treacle mustard, or mithridate mustard, juice of the rape of cistus, acacia, or in its stead Japan earth, gum arabic, storax strained, sagapenum strained, Lemnian earth, or in its stead bole armenic or French bole, green vitriol calcined, of each half an ounce; root of creeping birthwort, or in its stead of the long birthwort, tops of the lesser centaury, seeds of the carrot of Crete, opopanax, galbanum strained, Russia castor, Jew's pitch, or in its stead, white amber prepared, root of the sweet flag, of each two drams; of clarified honey, thrice the weight of all the rest. The ingredients are to be mixed in the same manner as in the mithridate.

The college of Edinburgh have given the following reformation of this composition, under the title of Theriaca Edinensis.

Take of Virginian snake root, six ounces; wild valerian root, contrayerva root, each four ounces; aromatic powder, three ounces; resin of guaiacum, Russia castor, myrrh, each two ounces; English saffron, opium, each one ounce; clarified honey, thrice the weight of the powders; canary wine, as much as is sufficient to dissolve the opium. This composition consists of very powerful ingredients, and is doubtless capable of answering every thing that can be reasonably expected from the more voluminous theriaca of Andromachus.

The

The theriaca Andromachi is a reform of mithridate, made by Andromachus, phyſician to Nero; for the virtues whereof, ſee the article MITHRIDATE.

THERMÆ, artificial hot baths much uſed by the Romans.

THERMOMETER, an inſtrument for meaſuring the increaſe and decreaſe of the heat and cold of the air, by means of the elaſtic and expanſive power of bodies of the fluid ſort.

Many different ways, methods, and forms of conſtructing ſuch an uſeful inſtrument have been thought of, and invented at ſeveral times for this purpoſe; at firſt air, then oil, then ſpirits of wine, and laſtly, quickſilver, have been every way attempted and tortured in this experiment.

The ſpring of air, being ſooner affected by heat and cold than that of any other fluid, was firſt thought upon as the beſt expedient to anſwer this end; and ſo it really would be, were it not that the weight or preſſure of the atmoſphere affects it alſo at the ſame time; and by acting ſometimes with, ſometimes againſt it, renders the effect by heat or cold very uncertain, and, therefore, the inſtrument uſeleſs. For example: the air in the bottle AF (plate CXXVII. *fig.* 4.) will, by its expanſion, when the air grows warmer, raiſe the water higher in the tube than the point H, and if the air be lighter at this time, it will preſs leſs on the ſurface of the water at H, and ſo will ſuffer it to riſe ſtill higher. But if the air be heavier, it will act againſt the ſpring, and not permit it to raiſe the water ſo high. The ſame may be obſerved with reſpect to its contraction by cold; wherefore ſuch an inſtrument, for common or conſtant uſe, will not do at all, though, perhaps, none is better calculated for ſome extemporaneous uſes, as meaſuring the degree of coldneſs in different cellars, or of warmth in divers rooms upon the ſame floor.

It was upon this account found neceſſary to have recourſe to ſome other fluid, which, ſecured from the preſſure of the air in a tube, hermetically ſealed, might expand and contract ſolely by the heat and coldneſs of the air about it. And, becauſe moſt fluids are ſubject to freeze, or thicken, in great degrees of cold, it was ſoon conſidered that ſpirits of wine, a little tinged with cochineal, would beſt anſwer the purpoſe; and, accordingly, thermometers were generally made therewith, and became of common uſe.

Though the ſpirit of wine thermometers would do very well to ſhew the comparative heat of the air, yet this was far ſhort of the virtuoſo's views, who wanted to explore the various and vaſtly different degrees of heat in other bodies, as boiling water, boiling oils, melted metals, and even fire itſelf, and degrees of cold too, beyond what the ſpirit thermometer can ſhew. For the ſpirit, in a moderate degree of heat, will burſt the tube; and, in an intenſe degree of cold, will freeze, as the French philoſophers found, who went to meaſure a degree upon the ſurface of the earth under the north polar circle. It having been found by experiment, that linſeed oil required four times the degree of heat to make it boil as water did, it was quickly ſubſtituted inſtead of ſpirits for philoſophic uſes. This Sir Iſaac Newton always uſed, and by it diſcovered the comparative degree of heat which makes water boil, which melts wax, which makes ſpirit of wine boil, and melts tin and lead; beyond which we do not find the oil-thermometer has been applied; for which reaſon, as alſo for its ſullying the tube, it has been leſs uſed of late, and given way to

The mercurial thermometer, which will ſuſtain any degree of heat or cold, as far as any inſtrument of this kind can be expected to do. Mr. Farenheit, of Amſterdam, was the contriver of this thermometer, and though ſeveral artificers made them as well as he, yet they ſtill go by his name. Dr. Boerhaave uſed only this thermometer. As the mercury very freely and uniformly expands itſelf from hard froſt to the heat of ſummer, ſo one ſort of thoſe thermometers are contrived with a ſcale, to include thoſe extremes only, and the beginning of the diviſions, or 0, is fixed to the altitude of the quickſilver, as is obſerved when water juſt begins to freeze, or ſnow to thaw; for which reaſon that is called the freezing point in the ſcale. This thermometer is ſmall, ſhort, put in a neat frame, and carried in the pocket any where.

But the grand thermometer of Farenheit is graduated after a different manner, as deſtined to a more critical and extenſive uſe. In this the bulb, or large part at the bottom, is not ſpherical, as in common ones, but cylindrical, to the end, that the heat may penetrate and reach the inmoſt parts as ſoon as poſſible, ſo that the whole may expand uniformly together. Hence it is, that in the cylindric bulb the fluid will expand and riſe immediately, whereas in the ſpherical bulb it is ſeen firſt to fall, by the ſudden expanſion of the ball, before the fluid is heated, and then to riſe, by the expanſion of the fluid when heated. We have given a figure, both of Farenheit's mercurial thermometer, and alſo of Sir. Iſaac Newton's made with linſeed oil. See plate CXXVII. *fig.* 5.

Sir Iſaac's ſeems to be the beſt fitted of any for a ſtandard weather thermometer; and even for any degree of heat which the various ſtates of the human body exhibit; and alſo for thoſe different degrees which vegetation requires in the green-houſe, hot-bed, &c. In all which caſes it is neceſſary there ſhould be one common, unerring, and univerſal meaſure, or ſtandard, which at all times, and at every place, will ſhew the ſame degree of heat, by the ſame expanſion of the fluid, according to which the ſcale ſhould be made in every ſtandard thermometer. In order to this, the tube propoſed ſhould be very nicely weighed, when empty, and then the bulb, and about a tenth part of the length of the tube above it, is to be filled with quickſilver; then it is to be weighed again, and the exceſs of this, above the former weight, will give the weight of the quickſilver poured in; this will give the weight of the hundredth part. Let a mark be made with a file upon the tube at the ſurface of the incloſed quickſilver.

Then weigh out nine or ten parcels of quickſilver, each equal to a hundredth part of that firſt put in the tube, and having poured the ſeveral parcels in one after another upon the incloſed quickſilver, and marked the tube ſucceſſively at the ſurface of each parcel, you will have the tube divided into proper intervals, which, if the bore of the tube be every-where the ſame, will be equal to each other; if not, they will be unequal; and each of theſe intervals is to be divided into ten others, increaſing or decreaſing as the intervals do.

When this is done, the capacity of the tube is divided into thouſandth parts of that of the ball, and the contiguous part of the tube reaching up to the firſt mark. The tube is now to be put into a frame, and by the ſide of it is to be placed a ſcale, divided into thouſandth parts, exactly correſponding to thoſe on the tube; and writing 1000 over-againſt the firſt mark, you write 1010 over-againſt the ſecond, 1020 againſt the third, and ſo on, as you ſee in the figure.

The ſtandard thermometer-tube, and its ſcale, being thus conſtructed, is then to be filled with ſome proper fluid, as linſeed-oil, where great degrees of heat are not propoſed; and mercury is to be uſed, when they are. When the fluid is poured in, it is to be adjuſted in ſuch a quantity, that it may ſtand juſt at the principal point; marked 1000, in water juſt freezing. And here great precaution is to be uſed; for many trials muſt determine this point to which the fluid muſt always riſe by ſlow degrees, and with an uniform motion.

When this point is well ſecured, all the trouble is over, the ball, being then immerſed in boiling water, ſpirits, oils, melted metals, &c. in ſnow, freezing mixtures, &c. the expanſions, by all the various degrees of heat and cold, will be ſhewn by the number againſt the heights to which the fluid riſes in the tube, in each caſe, theſe are to be wrote on the ſide of the ſcale; and, ſince the ſame degree of heat will cauſe the ſame expanſion of the ſame fluid at all times, it is evident, if thermometers were every where conſtructed in this manner, the obſervations made by them in any part of the world, may be compared together, which cannot otherwiſe be done; whence this part of philoſophy would receive its final perfection.

By one of thoſe ſtandard thermometers well made, many more might ſoon be conſtructed with any expand-

ing

ing fluid, without the trouble of graduating their tubes by equal quantities of quickſilver. For having filled the balls, and a convenient part of the tube, with the propoſed fluid, place them all together in a veſſel of cold water; and while it is warming as gently as poſſible, when the oil in the ſtandard thermometer ſhall arrive ſucceſſively at the ſeveral diviſions of its ſcale, at the ſame inſtant of time mark the new tubes at the ſeveral heights of their fluids, and form a ſcale for every tube, that ſhall correſpond to thoſe marks. Then, while the liquors ſubſide by cooling gently, examine whether they nicely agree at the ſeveral marks. To determine the freezing point in all, they are to ſtand together in the water till it juſt begins to freeze: or, having all the other points duly, that may be deduced very exactly by the rule of proportion.

A thermometer that ſhall vary very ſenſibly by every ſmall variation of heat and cold, as thoſe of the atmoſphere, muſt have a large ball in proportion to the bore of the tube; and, that the heat or cold may ſooner penetrate the innermoſt parts of the liquor, the ball ſhould not be ſpherical, but oblong, and flatted like a French flaſk; and the lengths of the tubes ſhould be proportioned to the degrees of heat they are intended to diſcover.

Sir Iſaac Newton graduated his ſtandard thermometer on both ſides, as ſhewn in the figure. Thoſe on the right hand meaſured the heat of the oil; as thoſe on the left meaſured the bulk thereof: but ſince the latter, as well as the former, begins from a cypher at the freezing point, and is regularly continued upwards by the common diviſions 10, 20, 30, 40, &c. it will equally ſerve both purpoſes; ſince the degree of heat will always be proportioned to the expanſion of the bulk of the fluid above or below the freezing point.

By this diviſion therefore on the left hand, we ſhall expreſs ſome of the principal articles of Sir Iſaac Newton's ſcale of the various degrees of heat, as in the table below.

D. of heat.	
0	Water juſt freezing, and ſnow juſt thawing.
1 to 4	The heats of the air in winter.
4 to 8	The heats of the air in ſpring and autumn.
8 to 12	The heats of the air in ſummer.
13	The greateſt ſummer-heat.
26	The greateſt heat of the external parts of the human body.
31	Water juſt tolerable to the hand at reſt.
36½	Water hardly tolerable to the hand in motion.
43	Melted wax juſt growing ſtiff and opake.
51½	Melted wax juſt before it bubbles or boils.
54	Spirit of wine juſt begins to boil.
72	Water begins to boil.
75	Water boils vehemently.
86	A mixture of $\frac{1}{10}$ of lead, $\frac{2}{5}$ of tin, and $\frac{1}{2}$ biſmuth, melts.
103	A mixture of equal parts of tin and biſmuth melts.
122	A mixture of $\frac{3}{5}$ of tin and $\frac{2}{5}$ of lead melts.
154	The heat which melts tin.
174	The heat which melts biſmuth.
206	The leaſt heat which melts lead.
290	The heat with which burning bodies ſhine in a dark place.
410	The heat of a ſmall coal-fire.
450	The heat of a ſmall wood-fire.

Dr. Hales conſiders the freezing point as one boundary to vegetation, viz. on the ſide of cold; and the other boundary he fixes to that degree of heat with which wax will begin to melt, becauſe a greater degree of heat will, inſtead of collecting and aſſimilating the nutritive particles, diſſipate them, even thoſe which are moſt viſcid and glutinous; and therefore the plant will rather fade than vegetate in ſuch degrees of heat.

This ſpace the doctor divided into one hundred equal parts in his thermometers: but his numbers, expreſſed in thoſe of the ſtandard thermometer, are for ſeveral particulars mentioned by the doctor as follows: For myrtle, 4½; oranges, 6½; ficoides, 7½; Indian fig, 8¼; aloe, 10; cereus, 11; euphorbium, 12; pimento, 13; ananas, 14½; melon-thiſtle, 15¼; air under the glaſs of a hot bed, 17; the hot bed itſelf, 28. If the hot bed exceed the heat of 40, or thereabouts, it will ſcorch the plants and kill them. The heat of milk from the cow is 28; that of urine 29; and of blood in a fever nearly 40.

As Farenheit's thermometer is come into ſuch general uſe, we have here placed it by the ſtandard thermometer, that the diviſions on each may be reduced to the other's reſpectively by bare inſpection, and the uſe of both be ſtill preſerved. If the reader would ſee all the different ſorts of thermometers, or rather all the different methods of graduating them, he may be fully ſatisfied by conſulting Dr. George Martin's treatiſe on this ſubject.

The following account of the uſe of thermometers among gardeners, in the management of ſtoves, &c. is taken from Mr. *Miller's Gard. Dict.*

Theſe inſtruments ſhew, by inſpection, the preſent condition of the air, whether it be hot or cold; which day in ſummer is the hotteſt, and in the winter which is the coldeſt, or any part of the day; and from thence many uſeful experiments have and may be made, viz. how much one ſpring exceeds another in coldneſs; which baths are the hotteſt or coldeſt; and, if being held in the hand of a perſon in a fever, or otherwiſe applied, will nicely ſhew the abatement or increaſe of a fever.

The common thermometer, which is uſed for hot houſes, has a tube of about two feet in length, and about the eighth part of an inch diameter; and in this it is remarked, that the air is cold for the plants when the ſpirit riſes to fifteen inches above froſt; that it is temperate at ſixteen inches and a half; that it is warm when it riſes to eighteen inches, which is the ſtandard for pine-apple heat. It is marked for hot air at twenty inches, and ſultry hot at twenty-one and a half; but in the common thermometers, theſe degrees are differently marked: this temperate air is about our warm, this warm air our hot, and our hot air is about the ſame as the ſultry.

Theſe thermometers are marked with the names of ſome of the remarkable plants which are preſerved in the hot houſes; but as the number of theſe plants has been greatly increaſed in England of late years, I have directed ſome thermometers to be made with a ſcale, divided into degrees, and with three different points of heat marked in claſſes, which correſpond with theſe thermometers; and under each claſs, I have drawn up liſts of the ſeveral plants, ranged according to the degrees of heat in which they are found to ſucceed, whereby the culture of them is made eaſy to perſons of ſmall ſkill. By this means every gardener may know when it is proper to apply his heat in its full force, and what degree of heat ought to be uſed for the welfare of any plant from any part of the world.

Mr. Boyle, by placing a thermometer in a cave, which was cut ſtrait into the bottom of a cliff, fronting the ſea, to the depth of 130 feet, found the ſpirit ſtood, both in winter and ſummer, at a ſmall diviſion above temperate; the cave had 80 feet depth of earth above it.

I, ſays, Dr. Hales, marked ſix thermometers numerically, 1, 2, 3, 4, 5, 6. The thermometer, number 1, which was the ſhorteſt, I placed with a ſouth aſpect in the open air; the ball of number 2, I ſet two inches under ground; that of number 3, four inches; number 4, eight inches; number 5, ſixteen inches; and number 6, twenty-four inches: and, that the heat of the earth at thoſe ſeveral depths may the more accurately be known, it is proper to place near each thermometer a glaſs tube, ſealed at both ends, of the ſame length with the ſtems or the ſeveral thermometers, and with tinged ſpirit of wine in them to the ſame height as in each correſponding thermometer; the ſcale of degrees of each thermometer being marked on a ſliding ruler, with an index to the back of it pointing to the correſponding tube.

When at any time an obſervation is to be made, by moving the index to point to the top of the ſpirit in that

tube

tube, an accurate allowance is hereby made for very different degrees of heat and cold in the ſtems of the thermometers at all depths; by which means the ſcale of degrees will ſhew truly the degrees of heat in the balls of the thermometers, and conſequently the reſpective heats of the earth at the ſeveral depths where they are placed.

The ſtems of theſe thermometers, which were above the ground, were fenced from weather and injuries, by ſquare wooden tubes. The ground they were placed in was a brick earth in the middle of my garden.

July the thirtieth I began to keep a regiſter of their riſe and fall: during the following month of Auguſt I obſerved, that when the ſpirit in the thermometer, number 1, which was expoſed to the ſun, was about noon, riſen to 48 degrees, then the ſecond thermometer was 45, the fifth 33, and the ſixth 31; the third and fourth at intermediate degrees; the fifth and ſixth thermometers kept nearly the ſame degree of heat, both night and day, till towards the latter end of the month, when, as the days grew ſhorter and cooler, and the nights longer and cooler, they then fell to 25 and 27 degrees.

Now ſo conſiderable a heat as the ſun, at two feet depth under the earth's ſurface, muſt needs have a ſtrong influence in raiſing the moiſture at that and greater depths, whereby a very great and continual reek muſt always be aſcending during the warm ſummer ſeaſon, by night as well as by day; for the heat at two feet depth is nearly the ſame night and day, the impulſe of the ſunbeams giving the moiſture of the earth a briſk undulating motion; which watery particles, when ſeparated and rarefied by heat, aſcend in the form of a vapour; and the vigour of the warm and confined vapour, ſuch as is that which is one, two, or three feet deep in the earth, muſt be very conſiderable, ſo as to penetrate the roots with ſome vigour, as we may reaſonably ſuppoſe from the vaſt force of confined vapour in æolipiles, in the digeſter of bones, and the engine to raiſe water by fire.

If plants were not in this manner ſupplied with moiſture, it were impoſſible for them to ſubſiſt under the ſcorching heats within the Tropics, where they have no rain for many months together; for though the dews are much greater there than in theſe more northern climates, yet, doubtleſs, where the heat ſo much exceeds ours, the whole quantity evaporated in a day there, does as far exceed the quantity that falls by night in dew, as the quantity evaporated here in a ſummer's day is found to exceed the quantity of dew which falls in the night.

But the dew which falls in the hot ſummer ſeaſon, cannot poſſibly be of any benefit to the roots of trees, becauſe it is remanded back from the earth by the following day's heat, before ſo ſmall a quantity of moiſture can have ſoaked to any conſiderable depth.

The great benefit therefore of dew in hot weather muſt be, by being plentifully imbibed into vegetables, thereby not only refreſhing them for the preſent, but alſo furniſhing them with a freſh ſupply of moiſture towards the great expences of the ſucceeding day.

It is therefore probable, that the roots of trees and plants are thus, by means of the ſun's warmth, conſtantly irrigated with freſh ſupplies of moiſture, which, by the ſame means, inſinuates itſelf with ſome vigour into the roots; for if the moiſture of the earth were not thus actuated, the roots muſt then receive all their nouriſhment merely by imbibing the next adjoining moiſture from the earth; and conſequently the ſhell of the earth, next the ſurface of the roots, would always be conſiderably drier the nearer it is to the root, which I have not obſerved to be ſo.

But when, towards the latter end of October, the vigour of the ſun's influence is ſo much abated, that the firſt thermometer was fallen to three degrees above the freezing point, the ſecond to ten degrees, the fifth to fourteen degrees, and the ſixth to ſixteen degrees; then the briſk undulations of the moiſture of the earth, and alſo of the aſcending ſap, much abating, the leaves faded and fell off.

The greateſt degree of cold, in the following winter, was in the firſt twelve days of November; during which time, the ſpirit in the firſt thermometer was fallen four degrees below the freezing point; the deepeſt thermometer ten degrees; the ice on ponds was an inch thick; the ſun's greateſt warmth at the winter ſolſtice, in a very ſerene, calm, froſty day, was, againſt a ſouth aſpect of a wall, nineteen degrees, and, in a free open air, but eleven degrees above the freezing point.

From the tenth of January to the twenty-ninth of March was a very dry ſeaſon, when the green wheat was generally the fineſt that was ever remembered: but from the twenty-ninth of March 1725, to the twenty-ninth of September following, it rained more or leſs every day, except ten or twelve days about the beginning of July; and that whole ſeaſon continued ſo very cool, that the ſpirit in the firſt thermometer roſe but to 24 degrees, except now and then a ſhort interval of ſun-ſhine; the ſecond only to twenty, the fifth and ſixth to twenty-four, and twenty-three degrees, with very little variation; ſo that, during this whole ſummer, thoſe parts of roots which were two feet under ground, had three or four degrees more warmth than thoſe which were but two inches under ground; and, at a medium, the general degree of heat through this whole ſummer, both above and under ground, was not greater than the middle of the preceding September.

THERMOSCOPE, an inſtrument ſhewing the changes happening in the air with reſpect to heat and cold.

The word thermoſcope is generally uſed indifferently with that of thermometer, though there is ſome difference in the literal import of the two; the firſt ſignifying an inſtrument that ſhews, or exhibits, the changes of heat, &c. to the eye; and the latter an inſtrument that meaſures thoſe changes; on which foundation the thermometer ſhould be a more accurate thermoſcope, &c. This difference the excellent Wolfius taking hold of, deſcribes all the thermometers in uſe as thermoſcopes; ſhewing that none of them properly meaſures the heat, &c. none of them do more than indicate the ſame. Though their different heights, yeſterday and to-day, ſhew a difference of heat, yet, ſince they do not diſcover the ratio of yeſterday's heat to to-day's, they are not ſtrictly thermometers.

THESEA, in antiquity, feaſts celebrated, by the Athenians, in honour of Theſeus.

THESIS, a general propoſition which a perſon advances and offers to maintain.

In colleges it is frequent to have placards, containing a number of them, in theology, in medicine, in philoſophy, in law, &c.

THEURGY, a name given to that part of magic called white magic, or the white art. Thoſe who have written of magic have divided it into three kinds; the firſt is theurgy, as operating by divine means: the ſecond, natural magic; performed by the powers of nature: and the third, necromancy; which they imagined proceeded from invoking dæmons.

THIGH, in anatomy, that part of the body of men, quadrupeds, and birds, between the leg and the trunk.

The ſeveral parts of the thigh have different names: the fore and upper part is joined to the groin, or inguen; the ſide makes the haunch, or hip, coxa, coxendix; the upper hind part, the buttock, clunis: the lower and hind part of the ham, poples, of *poſt* and *plico*, becauſe it bends backwards; and the fore-part of the knee, genu, of the Greeks γονυ, which ſignifies the ſame. The bone of the thigh is the largeſt and ſtrongeſt of the whole human body, as being to bear the whole burthen thereof; whence its name femur, of *fero*, to bear.

Fractures and Luxations of the THIGH. The thigh-bone, though the largeſt and ſtouteſt in the whole body, is yet frequently broken, both near its middle and towards its ends or articulation, but more particularly near that part called its neck, near its articulation with the hip-bone; and when this is the caſe it is very difficult to ſet it, and retain it in its place. When the bone is broken in two places at once, which ſometimes happens, the danger is much greater. Sometimes this bone is broken tranſverſely, ſometimes obliquely, and at other times the ends ſlip in a great way over one another, notwithſtanding the utmoſt caution in ſetting it. It is

therefore neceſſary in theſe caſes, according to Heiſter, beſides the means that are common to all the fractures, to uſe a more ſtrict and tight bandage in this than in the tranſverſe fracture, to prevent the bones from being eaſily removed. When a fracture of the thigh-bone happens near the middle, or towards its lower-head, it is to be extended and replaced with the hands like other fractures, except that the extending force required is very great; and where the hands of a ſtrong aſſiſtant are not enough, ſlings, napkins, or linen-bandages are to be bound round each head of the thigh, whereby the fractured bone may be extended both ways by the ſtrength of three or four perſons at once, while the ſurgeon cautiouſly reduces the fracture with his hands, and ſecures it with a proper bandage and dreſſing: and there are ſometimes caſes where the joint ſtrength of three or four men applied in this manner, is not ſufficient to make the neceſſary extenſion; in which caſe the ſurgeon is obliged to have recourſe to ropes and pullies, by means of which one man will pull more forcibly and equally than ſeveral can without them: but caſes that require this treatment are not common.

When the neck of the thigh-bone is fractured, to which, from its oblique or tranſverſe direction, and ſpongy or brittle ſubſtance, it is very ſubject, it makes a fracture not only difficult to reduce, but ſuch a one as can ſeldom be cured without leaving the limb ſhorter than it was before. The reaſons of which are, that the fragments cannot, but with great difficulty, be preſſed into their right places, by reaſon of the great thickneſs and ſtrength of the muſcles which cover them; and, that it ſeldom happens that the bones can be retained in their natural poſition, after they have been ever ſo well reduced; becauſe the muſcles which paſs over, and are inſerted below, the neck of this bone, draw its lower part upwards: to which it may be added, that it is very difficult to diſcover when the neck of the thigh-bone is fractured; this caſe being uſually taken for the head of the bone being ſlipped out of its ſocket. If the fracture of the bone be accompanied with a wound, it makes the caſe very difficult and dangerous; and if theſe accidents happen to be inflicted on the neighbouring joint, death is generally the conſequence, more eſpecially when any of the large veſſels are wounded.

The thigh-bone, Heiſter obſerves, is found to be capable of luxation four ways, upwards and downwards, and backwards and forwards; but it is moſt frequently diſlocated downward and inward, towards the large foramen in the os pubis. For beſides that the cartilaginous defence on the lower part of the acetabulum is not ſo high as on the reſt, the ligamentum rotundum is ever found to give way more readily in that part than in any other; and, laſtly, the adjacent muſcles are found to be weakeſt on this part. And there is beſides, a certain eminence in this edge of the acetabulum which prevents the head of the bone from falling back again eaſily into its right place when once it is got this way out of it. But if the head of this bone be diſplaced outwards, it generally ſlips upwards at the ſame time, it being ſcarce poſſible but that the very ſtrong muſcles of the thigh muſt then draw the bone upwards; and there is no eminence in this edge of the acetabulum to reſiſt the head of the bone in that paſſage.

When the thigh is diſlocated forwards and downwards, which is what moſt uſually is the caſe, the leg hangs ſtraddling outward, and is longer than the other; the knee and foot alſo both turn outwards, and the head of the bone itſelf will be felt near the lower part of the inguen and os pubis. Sometimes there is a ſuppreſſion of urine in this caſe, which is occaſioned by ſome nerve which communicates with the bladder being violently compreſſed; in the buttock there alſo may be perceived a cavity from the trochanter major, and the reſt of the bones being diſplaced; and if the thigh-bone be not timely reduced into its acetabulum, the whole limb withers ſoon afterwards. The patient, for this reaſon, can bear little or no ſtreſs upon that limb, but muſt always incline and throw the weight of his body upon the other: when he moves forward, he muſt move that limb in form of a ſemicircle, and ſupport his body by crutches under the arms: though there are not wanting particular caſes where the head of the luxated thigh-bone has grown ſo firmly to the adjacent part, without the acetabulum, as to become, in proceſs of time, ſo ſtrong as to ſupport the body without ſticks, though the perſon could not, in any of the caſes that have been known of this kind, walk without halting.

If the thigh-bone be diſplaced backward, it is uſually drawn upward alſo, as before obſerved, at the ſame time; hence there will be perceived, in this caſe, a cavity behind the inguen, and a tumour upon the buttock, becauſe the head, and trochanter of this bone, will be placed there. The tumour on the buttock being thruſt upward, the limb will become ſhorter than before, and the foot will be inclined to turn inwards. The heel will not touch the ground, but the perſon ſeem to ſtand upon his toes; and laſtly, the luxated limb will be much more eaſily bent than extended.

It is extremely rare that the thigh is luxated forward or backward, without being alſo drawn upward or downward; but if it ſhould ſo happen, it will yet evidently be diſcovered by the rules before given, and by conſidering the nature of the articulation of the bone: as it is, however, at beſt very difficult to diſcover when the thigh-bone is diſlocated, and when it is fractured, either by feeling or inſpecting, becauſe of the great thickneſs of the muſcles and integuments; it is therefore a matter of ſome conſequence to propoſe the ſigns by which one of theſe caſes may be known from the other. There is reaſon to judge the thigh-bone to be luxated when we find the ligaments of the bone have been relaxed by ſome preceding congeſtion of humours, when no external violence has been exerted upon it, when neither violent pain, tumours, nor inflammation follow; and laſtly, when the whole limb may be bent, and turned about at the acetabulum, without the ſurgeon's diſcovering any grating or cruſhing of the bones; and the contrary of theſe ſigns, which are what uſually take place, in what have been uſed to be called luxations of this bone, are very ſtrong indications of a fracture.

When the bone is found to be really diſlocated, it is to be reduced in a method agreeable to the nature and direction of the diſlocation. When it is diſplaced forward and downward, the patient is to be laid flat upon his back on a table; then a linen napkin, or ſtrong ſling, is to be made faſt about the groin, over the part affected, ſo that one end of the ſling may come over the belly, and the other over the nates and back, to be both tied together in a knot upon the ſpine of the os ileum, and afterwards either faſtened to a hook fixed in ſome poſt, or held firm by ſome aſſiſtance: in like manner, at the bottom of the thigh, a little above the knee, there muſt be faſtened another napkin or ſling, or elſe the girt of Hildanus, with a compreſs between it and the thigh; both theſe ſlings being drawn tight, the thigh is to be extended, but that not vehemently, but only ſo much as is ſufficient to draw the bone out of its ſinus, that it may be replaced into its proper acetabulum by the ſurgeon's hands; to this purpoſe the ſurgeon is, with one hand to preſs the head of the thigh-bone outward, while the other conducts the knee inward. Or the reduction may be made by napkins faſtened about the thigh near its extremities, in the manner of ſlings, and the limb extended that way, the knee being at the ſame time preſſed inward by the hands.

If theſe methods are not ſufficient, it will be neceſſary to have recourſe to the polyſpaſton, or pulley, well known to the ſurgeons on theſe occaſions. This is to be the method of reduction of the thigh-bone when it is diſlocated forward; but when it is found to be luxated backward, the patient is to be placed flat on a table, with his face downward; the thigh is then to be extended more ſtrongly than in the former caſe, and the reduction is to be performed by the ſurgeon's hand, an aſſiſtant all the while turning the limb ſomewhat inwards; and by this method the head of the thigh-bone generally ſlips very readily from this ſort of diſlocation into its proper place. The limb is then to be ſecured with proper bandages, and the patient to be kept to his bed for three or four weeks.

THIMBLE, an inſtrument made of braſs, ſilver, iron, &c. put on the finger to thruſt a needle through

any cloth, ſilk, &c. uſed by all ſeamſtreſſes, taylors, &c.

The art of thimble-making was brought from Holland, by Mr. John Lofting, a Dutchman, in 1695, who ſet up a workſhop at Iſlington, and practiſed it with ſucceſs.

Thimbles are made of ſhruff, or old hammered braſs, the beſt being too dear, and the ordinary too brittle.

This they melt and caſt in a ſort of ſand, procured only at Highgate, with which and red okre are made mould and cores, and in them they uſually caſt ſix groſs at a caſt, and about ſix or ſeven of theſe caſts in a day. They are caſt in double rows, and, when cold, taken out and cut off with greaſy ſhears.

Then boys take out the cores from the inſide with a pointed piece of iron, which cores were made by them, every core having a nail with a broad head in it, which head keeps it from the mould, and makes the hollow to caſt it in. This done, they are put into a barrel as they do ſhot, and turned round with a horſe, till they rub the ſand one from another.

Thus far the foundery, in which are employed ſix perſons: firſt, the founder and two men make the moulds ready. Secondly, two boys make cores, for each thimble one. Thirdly, one that blows the bellows. From hence they are carried to the mill to be turned.

Firſt, the inſide, which works with an inſtrument to the bottom, while its hold laſts, and flies back, when let looſe. Secondly, the outſide, which with a coarſer engine called a rough turning, is made pretty ſmooth at one ſtroke; and afterwards with a finer engine both the ſide and bottom are at one ſtroke made very ſmooth. Then ſome ſaw-duſt or filings of horn combs are put half way into each thimble, and upon it an iron punch, and then, with one blow againſt a ſtudded ſteed, the hollow of the bottom is made.

After this with an engine the ſides have the hollow made, and in this engine is their chief ſecret, and they can work off with it thirty or forty groſs in a day. This done, they are again poliſhed on the inſide. Then the rim, whether a ſingle or double one, are turned at one ſtroke, and all theſe turnings are performed with five men and three boys.

After this, they are again turned in the barrel with ſaw-duſt or bran to ſcour them very bright, and ſo they are complete thimbles. Thus finiſhed, they are ſorted, and put ſix together one in another; and ſix of theſe half dozens are wrapped up in a blue paper; and four of theſe papers, making a groſs, are wrapped up in another paper, and tied with a packthread, which makes them almoſt a ſquare, and are ſold by the firſt maker at four or five ſhillings the groſs.

THINKING, *Cogitatio*, a general name for any act or open action of the mind. When the mind turns to view inwards upon itſelf, the firſt idea that offers, ſays Mr. Locke, is thinking, wherein it obſerves a great variety of modifications, and thereof frames to itſelf diſtinct ideas. Thus, the perception annexed to an impreſſion on the body made by an external object, is called ſenſation. When an idea recurs without the preſence of the object, it is called remembrance. When ſought after by the mind, and brought again to view, it is called recollection. When held long there under attentive conſideration, it is contemplation. When ideas float in the mind with regard or reflection, it is called a revery; when they are taken expreſs notice of, and as it were regiſtered in the memory, it is called attention; and when the mind fixes its view on any one idea, and conſiders it on all ſides, it is ſtudy and intention. Theſe are the moſt obvious modes of thinking; but there are ſeveral others yet, and, doubtleſs, the mind is capable of infinite others, which we have no notion at all of. The Carteſians hold that it is impoſſible to conceive a mind which does not think, thought alone being the eſſence of the mind; and that there is no time when the ſoul does not think: but this doctrine is overturned by Mr. Locke, who ſhews that in ſleep, without dreaming, there is an entire receſſion of all the modes of thinking.

The ſchool philoſophers uſually divide thinking, with regard to the object it is employed about, into understanding and willing, which are therefore ſaid to be two powers or faculties of the human mind. Intellectual thinking is further ſubdivided into divers kinds. Thus, when the mind merely apprehends or takes notice of a thing, it is called perception. When it affirms or denies a thing, judgment: when it gathers or infers a thing from others given, reaſoning; and when it diſpoſes its own thoughts or ideas in order, method. Willing or volatile knowledge admits of infinite different modifications or determinations. Some authors extend the idea of thinking further; and conſider it as exiſting in God, angels, men, and brutes; and divide it into divine, angelical, human, and animal or ſenſitive. The two firſt we know little or nothing of; the third is what we have already been treating of; and, as to animal or ſenſitive thought, it is defined to be an action of the ſoul attending to an external object, effected by means of the animal ſpirits duly agitated in the brain to excite an idea.

THIRD, in muſic, a concord reſulting from a mixture of two ſounds, containing an interval of two degrees.

It is called third, as containing three terms or ſounds, between the extremes. The third, in Italian *terza*, in French *tierce*, in Latin *tertia*, has no general name in the Greek: it is the firſt of the imperfect concords, that is, of ſuch as admit of majority and minority, without ceaſing to be concords. And hence it is diſtinguiſhed into two kinds. The firſt, which the Italians call *ditono*, from the Greek *ditonos*, or *terza maggiore*, and the greater third, is compoſed diatonically of three terms or ſounds, containing two degrees or intervals, one of which, in the antient ſyſtem, is a greater tone, and the other, a leſſer tone; but, in the modern temperate ſyſtem, they are both equal, as *ut*, *re*, *mi*; or *ut mi*.

Chromatically it is compoſed of four ſemi-tones, two of which are greater, and the third leſs; it takes its form from the ratio ſeſquiquarta, 4: 5.

The ſecond third, which the Italians call *trihemituono*, or *ſemi-ditono*, or *terza minore*, and we leſſer third, is compoſed like the former, of three ſounds or terms, and two degrees or intervals; but theſe degrees, diatonically, are only a greater tone and ſemi-tone.

Chromatically it is compoſed of three tones, two greater and one leſs; as *re*, *mi*, *fa*; or *re*, *fa*.

It takes its form from the ratio ſeſquiquinta, 5: 6.

Both theſe thirds are of admirable uſe in melody, and make, as it were, the foundation and life of harmony.

THIRD POINT, or TIERCE POINT, in architecture, the point of ſection in the vertex of an equilateral triangle.

Arches or vaults of the third point, called by the Italians *di terzo acuto*, are thoſe conſiſting of two arches of a circle meeting in an angle a-top.

THIRST, a painful ſenſation, occaſioned by a preternatural vellication of the nerves of the throat or fauces, and producing a deſire of drinking.

Rohault accounts for thirſt thus; the ſtomach liquor which ordinarily reſolves into a thick vapour, and aſcends from the ſtomach up into the throat, to moiſten it, being too much warmed and agitated, either from a want of ſome other liquor to temper and dilute it, or from any other cauſe, becoming converted into too thin, ſubtile and penetrating vapour, is ſo far from moiſtening and cooling the throat, that on the contrary it dries and heats it, and hence that motion in the nerves, the ſenſation of which we call thirſt: thirſt ſometimes alſo ariſes from a mere dryneſs of the part; and ſometimes from ſharp ſalts, more immediately vellicating the fibres of the throat.

There are various kinds of liquor which quench thirſt, ſome by tempering the ſtomach liquor; others by diluting, and even diſſolving the ſalt; and others by moiſtening and ſupplying the fibres.—Acids are peculiarly fitted for that end.

Thirſt is ſometimes eluded by rolling a leaden bullet or pebble in the mouth, which occaſions an extraordinary iſſue of ſaliva to moiſten the throat, &c.

THISTLE, *Carduus*, in botany. See the article CARDUUS.

THISTLE *Fly*, in natural hiſtory, a ſmall fly produced from a fly-worm, hatching in the protuberances of the carduus hæmorrhoidalis. In the protuberances of this thiſtle, while they are cloſed in all parts, the worm of this fly, from whoſe injuring it, at the time of depoſiting the egg from which it was hatched, the protuberances aroſe, undergoes its laſt transformation, It here makes of its own ſkin a ſhell, in form of an egg, within which it puts on the nymph ſtate. When this nymph becomes a living fly, the leaſt part of its difficulty is the finding its way out of this ſhell; it has a much ſtronger priſon than that, and before it can obtain its liberty, muſt force its way through the much more cloſely compacted fibres of the protuberance of the vegetable. It has, however, no other means of doing this difficult and laborious work but that of inflating its head, and throwing out the bladder or muzzle with which all theſe creatures are, by bountiful nature, provided in this ſtate.

This is a difficult operation, and many of the creatures periſh in the attempt; but, what much forwards the ſucceſs of it, in many caſes, is, that the ſtalk of the thiſtle often becomes naturally half rotten before the time of the fly's egreſs. *Reaumur, Hiſt. Inſ.*

Order of the THISTLE, or *of St.* ANDREW, a military order of knighthood in Scotland, the riſe and inſtitution of which is variouſly related by different authors: Leſley, biſhop of Roſs, reports, that the night before the battle between Athelſtan king of Northumberland, and Hungus king of the Picts, a bright croſs, in form of that whereon St. Andrew, the tutelar ſaint of Scotland, ſuffered martyrdom, appeared to Hungus, who having gained the victory, ever after bore the figure of the croſs on his banners. Others aſſert that Achaius king of Scotland, firſt inſtituted this order, after having made the famous league offenſive and defenſive with Charlemagne king of France. But although the thiſtle had been acknowledged as the ſymbol of the kingdom of Scotland from the reign of Achaius, yet ſome refer the beginning of this order to the reign of Charles VII. of France. Others place the foundation of it as low as the year 1500.

The chief and principal enſign is a gold collar compoſed of thiſtles and ſprigs of rue interlinked with amulets of gold, having pendent thereunto the image of St. Andrew with his croſs, and the motto *Nemo Me Impune Laceſſet*; "Nobody ſhall provoke me unpuniſhed."

The ordinary or common enſign worn by the knights, is a ſtar of four ſilver points, and over them a green circle, bordered and lettered with gold, containing the ſaid motto, and in the center is a thiſtle, proper; all which is embroidered on their left breaſt, and worn with the collar, with a green ribband over the left ſhoulder, and brought under the right arm; pendent thereto is the image of St. Andrew, with his croſs, in a purple robe, with an oval of gold enamelled vert, with the former motto: but ſometimes they wear, enriched in the ſame manner, a thiſtle crowned.

About the time of the Reformation, this order was dropped, till James II. of England reſumed it, by creating eight knights: however, the Revolution unſettled it again, and it lay neglected till queen Anne, in 1703, reſtored it to the primitive deſign, of twelve knights of St. Andrew. King George I. in the firſt of his reign, confirmed the ſtatutes ſigned by queen Anne, with the addition of ſeveral more, among which was that of adding rays of glory to ſurround the figure of St. Andrew, which hangs at the collar: and though from the Reformation to George I. both elections and inſtallments had been diſpenſed with, his majeſty ordered that chapters of election ſhould, for the future, be held in the royal preſence; to which end he ordered the great wardrobe to provide the knights brethren, and officers, with ſuch mantles as the ſtatutes of the ſaid order appointed.

THLASPI, in botany, &c. a plant with oblong narrow undivided leaves joined immediately to the ſtalks, on the tops of which grow numerous tetrapetalous flowers, each of which is followed by a ſhort flat ſeed-veſſel divided tranſverſely into two cells.

THLASPI *arvenſe ſiliquis latis*, treacle-muſtard, with roundiſh-pointed jagged leaves, and broad capſules containing about four ſeeds in each cell. It is annual, and grows wild in corn-fields.

THLASPI *arvenſe, vaccariæ incano folio majus*, Mithridate muſtard, with hoary ſharp-pointed leaves ſhaped like an arrow-head; and only one ſeed in each cell. It is biennial, and grows in fields and open clayey grounds.

The ſeeds of theſe plants have an acrid biting taſte, approaching to that of the common muſtard; with which they agree nearly in their pharmaceutic properties, their pungent matter being totally extracted by water, only partially by rectified ſpirit, and being elevated by water in diſtillation. They have, joined to their acrimony, an unpleaſant flavour, ſomewhat of the garlic or onion kind; and this they give out to ſpirituous as well as watery menſtrua. They are rarely made uſe of any otherwiſe than as ingredients in the compoſitions whoſe names they bear: though ſome recommend them in different diſorders, preferably to the common muſtard.

THLIPSIS, θλῖψις, a compreſſion of the ſtomach from food, which is offenſive only by its quantity; and not endued with any remarkable quality; or from a conflux of humours, void of acrimony, into the part.

THOMÆANS, THOMEANS, THOMISTS, or *Chriſtians of St.* THOMAS, a people of the Eaſt Indies, who, according to tradition, received the Goſpel from St. Thomas. Upon the arrival of the Portugueſe at Calicut, in their firſt voyage to the Indies, they met with ancient Chriſtians, who pretended to be deſcended from thoſe converted by St. Thomas.

The Thomæans being informed of a new people arrived among them, who bore a particular veneration for the croſs, ſent ambaſſadors to them, to make an alliance with them, and to ſollicit their aſſiſtance againſt the Gentile princes, by whom they were greatly oppreſſed. A mixture of opinions, with a total interruption of paſtors, ſometimes for ſeveral years together, occaſioned that horrible chaos their religion was in, at the arrival of the Portugueſe; for a ſpecimen whereof we ſhall add their manner of celebrating the Euchariſt: Over their altar was a kind of gallery; and while the prieſt was ſaying the beginning of the office below, a cake of flour of rice was frying in oil, or butter, above: when enough, the cake was let down in a basket upon the altar, where the prieſt conſecrated it: as to the other ſpecies, for wine they uſed a kind of brandy or arrack, variouſly prepared in that country. Nor was their ordination much more regular; the archdeacon, who was ſometimes more reſpected than the biſhop himſelf, frequently ordained prieſts: their other abuſes were infinite. The Portugueſe, for theſe two laſt centuries, have laboured the reformation of this church, and have employed both the eccleſiaſtic and ſecular power therein: for this end they have called the Thomæan biſhops to the council at Goa, have inſtructed, charged them, &c. and even ſent them for inſtruction to Portugal and Rome; but finding that they were ſtill apt to relapſe at their return, and that no good was like to be done with them, they reſolved to exclude them once for all, and to appoint an European biſhop in their room. Theſe proceedings have rendered the Portugueſe infinitely odious to the Thomæans.

ST. THOMAS'S DAY, a feſtival of the Chriſtian church, obſerved on December 21, in commemoration of St. Thomas the apoſtle.

ST. THOMAS *of Canterbury's Day*, a feſtival of the Romiſh church, obſerved on December 29, in memory of Thomas Becket, archbiſhop of Canterbury, who was murdered, or, as the Romaniſts ſay, martyred, in the reign of king Henry II.

THOMISM, or THOMAISM, the doctrine of St. Thomas Aquinas, and his followers the Thomiſts, chiefly with regard to predeſtination and grace. There is ſome doubt what the true genuine Thomiſm is, but there are authors who diſtinguiſh the Thomiſm of St. Thomas from that of the Dominicans. Others again make Thomiſm no other than a kind of Janſeniſm diſguiſed: but Janſeniſm, it is known, has been condemned by the popes, which pure Thomiſm never was:

in effect, the writings of Alvarez and Lemos, who were appointed by their order to lay down and defend, before the holy ſee, the dogmata of their ſchool, have ſince been reputed the rule of pure Thomiſm. The modern ſchool has abandoned many of the antient Thomiſts, whoſe ſentiments and expreſſions appeared to Alvarez too hard; and the new Thomiſts, who paſs the bounds marked by theſe two doctors, cannot give their opinions for the ſentiments of the ſchool of St. Thomas, which the pope has forbid being cenſured. Thoſe two authors diſtinguiſh four claſſes of Thomiſts: the firſt, which they reject, deſtroys or takes away liberty; the ſecond and third do not differ from Molina; the laſt, which Alvarez embraces, admits of a phyſical premotion or predeſtination, which is a complement of the active power, whereby it paſſes from the firſt act into the ſecond, that is, from complete and next power to action. The premotion they hold is offered in ſufficient grace, ſufficient grace is given to all men, and that they have a complete independent, next power not to act, and even to reject the moſt efficacious grace.

THOMISTS, a ſect of ſchool divines, who maintain Thomiſm.

THORACIC, *Thoracicus*, a name given to two branches of the axillary artery, on account of their conveying the blood into ſome parts of the thorax.

The thoracic arteries are diſtinguiſhed into upper and lower. There are likewiſe thoracic veins, upper and under, deſtined for the conveyance of the blood from the thorax to the axillary vein.

THORACIC DUCT, or CHYLIFEROUS DUCT, a very ſlender canal, receiving the chyle from the chyliferous veſſels, and the lymph from the lymphatics, and carrying them to the thorax, and uſually through it to the ſubclavian vein. The beginning of this duct is in the reſervoir or receptaculum chyli, which is ſituated in the left ſide of the upper vertebra of the loins, under the aorta, and the veſſels of the left kidney; the reſt of the duct has ſome reſemblance of a ſack or bag, and is larger and more irregular in its figure. Its end is uſually in the ſubclavian vein; ſometimes in the jugular. In dogs, and many other animals, its progreſs is under the aorta; but in the human body it aſcends along the right ſide of the vertebra of the back, and paſſes between the aorta and the vena azygos, ſometimes with a ſimple trunk, ſometimes divided into two: its breadth, where divided, is about that of a wheat-ſtraw.

The beſt manner of demonſtrating it in animals, is to feed a dog well, and then to ſtrangle him; and as ſoon as the body is opened, to tie it up with a thread in the breaſt, juſt by the ſubclavian; by this means the ciſtern, or receptacle of the chyle, and the chyliferous veſſels and lymphatics are all expoſed evidently to view at once. In a human body they may alſo be obſerved any time after death, by injecting, according to Salzman, wax, or any fluid, or indeed only by inflating the great lymphatic veſſel, which runs by the left emulgent vein; or otherwiſe, if, according to Henninger, an injection, or barely an inflation, be made into a lacteal of the ſecond order, to be traced out in the middle of the meſentery; or, finally, if the pleura be carefully cut between the aorta and the vena azygos, the duct will uſually be eaſily found there. It is compoſed of a fine, thin, and pellucid membrane, and within it there are valves, as in the lacteals and lymphatics, which prevent the reflux of the chyle. There are more of theſe in the human body than in beaſts; and, finally, there is a ſemilunar valve, cloſing its extremity under the ſubclavian.

The uſe of the thoracic duct is to carry the chyle to the blood, through the thorax, as it receives it from the receptacle, and with it the lymph from the lymphatics.

THORAX, in anatomy, that part of the human body which forms the capacity of the breaſt, and wherein are included the heart and lungs.

All that lies between the baſis of the neck and the diaphragm, or midriff, that is, down to the laſt ribs, is called the thorax or cheſt. The fore-part of the thorax is called the breaſt; in it are the claviculæ or channel-bones, and the ſternum or breaſt-bone, which is in the middle; it begins at the claviculæ, and terminates in the cartilago xiphoides or ſword-like cartilage. Under the ſternum lies the mediaſtinum, and the heart in its pericardium. The mammæ or breaſts are two round tumours, which appear upon the fore-part of the cheſt, under which are ſituated part of the ribs, the pleura, and the lungs; there ſtands upon their center a little protuberance called papilla or nipple, which is encompaſſed by a reddiſh circle called arcola. The hollow in the middle of the breaſt, below the breaſts, is called ſcrobiculus cordis. The hinder part of the thorax is called the back, compoſed of twelve vertebræ or joints, and two ſcapulæ or ſhoulder-blades, which are the two upper parts of the back on the ſides of the vertebræ. The lateral parts of the thorax are called periſterna.

The uſes of the parts of the thorax in general, are their ſerving to reſpiration and the circulation of the blood, in both ſexes; and in women, to the producing milk.

Wounds of the THORAX, are, by Heiſter, divided into three ſorts. The wound is inflicted either upon the external parts of the thorax; or elſe it penetrates into the cavity of the thorax, without injuring any of its contents; or, laſtly, the contents of the thorax alſo partake of the wound. That the wound terminates in the exterior parts, and does not penetrate into the cavity of the thorax, may be diſcovered by ſeveral methods, as by the ſight, by hearing whether any ſound proceeds from the wound at the time of inſpiration, by feeling whether the finger or probe meets with any reſiſtance in attempting to paſs it into the cavity of the thorax, by injecting warm water, which, in this caſe, will return upon you; by the abſence of bad ſymptoms, which always attend a wound that penetrates. When, by theſe methods, you are fully ſatisfied that it does not penetrate, it may be dreſſed with a digeſtive ointment, or ſome vulnerary balſam, and treated according to the method directed in the cure of ſlight wounds.

But when the wound penetrates into the thorax, and a large quantity of blood falls into the cavity thereof, then the office of reſpiration, and the courſe of the blood through the lungs, will certainly be impeded; and the blood, by frequent delays and obſtructions, being entirely inſpiſſated in the lungs, life can no longer be ſupported: but where the quantity of extravaſated blood is not large enough to obſtruct the lungs in their office, the chief danger that the patient labours under, is that the extravaſated blood ſhould putrify by degrees, and corrupt the contents of the thorax, which will bring on very bad ſymptoms, and in a ſhort time death.

The following ſymptoms diſcover an extravaſation of blood in the thorax: if there is a great difficulty of breathing except when the patient is placed in an erect poſture; if the patient lies eaſieſt upon his back, or wounded ſide; if he feels a weight upon the diaphragm; if he perceives the undulation of a fluid upon turning the body round; and, laſtly, if there has been little or no diſcharge of blood by the wound. When it appears by theſe ſymptoms that there is a collection of blood in the thorax, the greateſt diligence is required to get it out; therefore when the wound is inflicted upon the middle or lower part of the thorax, and has not a very narrow opening, it will be convenient to lay the patient upon the wounded ſide, adviſing him to fetch his breath as deep as he can, or to cough. If the current of blood is obſtructed by any thick grumous parts, they muſt be removed with a probe or the finger, or drawn out with a ſyringe. If the blood is become too thick to flow out of the wound, attenuating injections muſt be uſed, made of a decoction of barley-water, with the addition of ſome common honey, or honey of roſes, and a ſmall quantity of ſoap; this is to be injected into the cavity of the thorax, and then the patient is to be ſo ſituated as to let it run out again: this operation is to be repeated, till it appears that all the grumous blood is waſhed away. But if the wound is ſo narrow or oblique, that this method cannot be proſecuted, the wound ſhould be enlarged, being careful not to fatigue the patient too much, by endeavouring to diſcharge all the

extravaſated blood at one time, keeping the wound open, dreſſing it with proper plaſters and compreſſes, ſecuring the whole with a ſcapulary, and repeating this method of dreſſing, till the diſcharge ſhall entirely ceaſe, and the external wound can be conveniently healed. When a wound is made in the upper part of the breaſt, no poſture will ſatisfy the intention of diſcharging the extravaſated blood, but ſtanding upon the head; an opening ought therefore to be made in the lower part of the thorax, called paracenteſis.

The cavity of the thorax being thus cleanſed, the wound is to be dreſſed but once every day: each dreſſing ſhould be performed with all poſſible expedition, and the utmoſt diligence ſhould be uſed to guard the contents of the thorax from the external air. At the time of dreſſing, a chaffing diſh of hot coals ſhould be held near the wound, to warm and thin the air: and if too great a quantity of air is already got into the cavity of the thorax, it muſt be drawn out with a ſyphon. When any of the contents of the thorax is wounded, as the heart, the aorta, the vena cava, the pulmonary artery or vein, the mediaſtinum, or a large portion of the lungs, death comes too ſuddenly to give the ſurgeon room to exerciſe his art. On the other hand, when the lungs are only ſlightly wounded, that is, when only the ramifications of the pulmonary vein and aſpera arteria are divided, the caſe is very dangerous, but not always mortal; though perſons who recover after wounds of this kind, are more obliged to the ſoundneſs of their conſtitution, than their ſurgeon's ſkill.

THORNBACK, in ichthyology, the prickly raia, with tuberculoſe teeth, and a tranſverſe cartilage in the belly.

The head and body are very flat and depreſſed; the figure of the body, excluſive of the tail, is nearly ſquare; the tail is long and ſlender, but a little depreſſed or flatted; the belly is altogether plane, but riſes a little in the middle into a convexity; the eyes ſtand on the uppermoſt part of the body, at a conſiderable diſtance from the roſtrum, and are a little protuberant, and covered with a ſimple and naked ſkin; behind each eye there is a ſingle oblong foramen, that runs tranſverſely, and its anterior ſide is ſtriated, and ſerves as a valve to cloſe up almoſt the whole aperture; the mouth is ſituated on the under ſide of the body, and lies in a tranſverſe direction, is very large, and ſtands at the ſame diſtance from the extremity of the roſtrum as the eyes do.

THOUGHT, or SENTIMENT, a general name for all the ideas conſequent on the operations of the mind, and even for the operations themſelves. See IDEA and THINKING.

THOUGHTS, in a boat, a name given by ſeamen to the benches on which the men ſit down to row.

THOWLES, is alſo a word uſed by ſeamen for thoſe pins in the gunnel of a boat, between which the men put their oars, when they row.

THRASHING, or THRESHING, *Flagellatio*, in agriculture, the art of beating the corn out of the ears.

There are two ways of ſeparating corn from the ear; the firſt by beating it with a flail, which is properly what is called thraſhing. The other method, ſtill practiſed in ſeveral countries, is to make mules, or horſes, trample on it, backwards and forwards; this is properly what the ancients called tritura and trituratio. The Hebrews uſed oxen therein, and ſometimes yoked four together for this purpoſe. Another way among the ancients was with a kind of ſledge, made of boards joined together, and loaden with ſtones or iron, upon which a man was mounted, and the whole drawn over the corn by horſes: this inſtrument was called traha, or tribula. It is a rule among huſbandmen, that the ſeaſon for thraſhing, is as ſoon as the corn has ſweated in the heap or mow.

THRAVE, or THREAVE, of corn, twenty-four ſheaves, or four ſhocks of ſix ſheaves to the ſhock; though, in ſome countries, they only reckon twelve ſhocks to the thrave.

THRAUSTOMITCHES, in natural hiſtory, the name of a genus of compound earths, the bodies of which are loams compoſed of ſand and a leſs viſcid clay, and are therefore of a friable or crumbly texture.

The earths of this genus are generally uſed to make bricks, and there are ſeveral ſpecies of them. 1. A whitiſh one, dug in great plenty in Staffordſhire, and ſome other countries. 2. A browniſh white one, very plentiful about London. 3. A pale yellow one, common in moſt parts of England, at ſmall depths. 4. A ſharp rough one, of a deep yellow, dug near the town of Hedgerly, near Windſor, and commonly called Windſor loam; it is not found in any other place, and is of great value; it makes the bricks uſed for the iron furnaces, and ſerves at the glaſs-houſes; and among the chemiſts, as a very ſtrong and valuable lute; and is not only uſed in England, but carried to Holland and Germany, and many other parts of the world. 5. A deep, duſky, yellow one, dug in moſt parts of England, near the ſurface. 6. A hard, brown one, found at ſome depth in Buckinghamſhire, and uſually found full of ſmall ſhells; it is uſed for covering the ridges of barns, and copings of walls; and makes very firm and durable barn-floors. 7. A light, pale, brown one, the looſeſt and moſt friable of all the ſpecies, uſed in many places for making the bell-founders moulds. 8. A yellowiſh brown one: this is common in moſt parts of the kingdom, and makes the fine red bricks, uſed for ornamenting buildings.

THREAD, in botany, is underſtood of thoſe threads uſually found in the middle of flowers; as in the lily, tulip, roſe, &c. — There are two kinds; thoſe which ſupport apices are particularly called ſtamina, and thoſe which have none ſimply threads.

The thread of the Laplanders is very fine, white, and ſtrong, but it is of a very different nature from ours; they know nothing of flax or hemp, nor of any other plant whoſe ſtalks might ſupply the place of theſe in making thread, but theirs is made of the ſinews of the rein-deer. They kill of theſe animals a very great number continually, partly for food, partly for the ſkins which they uſe in cloathing themſelves, covering their huts, and on many other occaſions; the ſinews of all that they kill are carefully preſerved, and delivered to the women, whoſe province it is to prepare this neceſſary matter. They beat the ſinews very well, and after having ſteeped them a long time in water, they ſpin them out.

The thread they thus make is of any degree of fineneſs they pleaſe; but it never is any longer than the ſinew from which it is made. They uſe this in ſewing their cloaths, ſhoes, gloves, &c. and the trappings of their rein-deer. The threads of the ſame ſinew are laid up together, and are all of a length; and as the different ſinews afford them of very different lengths, they accordingly pick out ſuch as the preſent uſe requires, both in regard to length and fineneſs. This ſort of thread is made with much more labour than ours; but it is greatly ſuperior to it on many occaſions, where ſtrength is rather required than beauty.

Theſe people have, beſides this, a way of making a ſort of yarn of ſheep's wool, which they weave into garters, and a ſort of ribbons, uſed by way of ornament; but they place no value on it, becauſe of its want of ſtrength.

THRICHECHUS, the ſea-cow, in zoology, a genus of ſea animals; it has teeth in both jaws; there is no fin upon the back, and the ſkin is very tough, firm, and hairy.

This creature ſeems to be the link uniting the fiſh and the quadruped tribes, as the bat does the quadrupeds and birds: it grows to fifteen feet, or more, in length, and is conſiderably thick in proportion.

The females have, between the pectoral fins, two large, round, and fair breaſts, and both ſexes have the parts of generation and the navel perfectly reſembling thoſe of the human ſpecies: there is no doubt, but all the fables concerning mermaids, mermen, and ſyrens, took their riſe from an imperfect view of this animal.

THRIPS, in the hiſtory of inſects, a genus of the order of ſcleropſtera, having the roſtrum obſcure, the body of a linear figure, and the wings four in number, being incumbent on the back, and ſtraight. It is an extremely ſmall inſect, not equal to a flea in ſize.

THROAT, the anterior part of an animal between the head and the ſhoulders, wherein is the gullet.

Phyſicians include, under the word throat, all the hollow or cavity which may be ſeen when the mouth is wide open.

It is ſometimes alſo called iſthmus, by reaſon it is narrow, and bears ſome reſemblance to thoſe ſtreights called by the geographers iſthmi.

THROAT, in architecture, fortification, &c. See GORGE.

THRONE, θρονος, a royal ſeat, or chair of ſtate, enriched with ornaments of architecture and ſculpture, made of ſome precious matter, raiſed on one or more ſteps, and covered with a kind of canopy. Such are the thrones in the rooms of audience of kings, and other ſovereigns.

THROWSTER, one who prepares raw ſilk for the weaver, by cleanſing and twiſting it.

THRUPTOMICTHES, in natural hiſtory, a genus of earths, conſiſting of moulds of a lax, friable texture.

Of this genus there are only two ſpecies. 1. The red thruptomicthes, frequent in many countries: but no where more plentifully than about Rowel, in Northamptonſhire: it is accounted a very fertile good land, and, particularly, ſucceeds with crops of rye, barley, or peaſe. 2. The friable, brown thruptomicthes, frequent in Suſſex, and in many other parts of the kingdom, and is generally accounted a poor, barren land.

THRUSH, in ornithology, two ſpecies of turdus, the one called the common thruſh, and the other the miſſel-thruſh.

The common thruſh is the turdus with a white line over the eyes. This is ſmaller than the fieldfare; the head is ſmall and flatted; the eyes are bright, their iris hazel; the ears patulous; the beak about half an inch long, brown and pointed; the head and back of an olive brown, ſpotted with a dark colour; the breaſt is yellow, the belly whitiſh, and the legs brown.

The other ſpecies of turdus, called the miſſel-thruſh, is of a greyiſh yellow colour with a ſpotted breaſt, being the largeſt of the turdus kind.

THULE, of the ancients, ſuppoſed to be the iſlands of Orcades.

THUMB, *Pollex*, in anatomy, one of the parts or extremities of the hand. See HAND.

The thumb, conſidered ſeparately, has bones thicker than thoſe of the fingers; the firſt of theſe agree in all reſpects with thoſe of the metacarpus, in figure, ſituation, and articulation; but in its motion it is widely different. The articulation of the firſt with the ſecond, and of the ſecond with the third, are like the articulations and motions of the ſecond and third phalanges of the other fingers.

THUNDER, a noiſe in the regions of the air, excited by a ſudden kindling of ſulphureous exhalations.

Thoſe philoſophers who maintain, that vapours are buoyed up in the air by particles of fire adhering to them, account for the phænomena of thunder and lightning in the following manner: they ſuppoſe that from the particles of ſulphur, nitre, and other combuſtible matter, which are exhaled from the earth, and carried into the higher regions of the atmoſphere, together with the aſcending vapours, is formed an inflammable ſubſtance, which, when a ſufficient quantity of fiery particles is ſeparated from the vapours, by the colliſion of two clouds, or otherwiſe, takes fire, and ſhoots out into a train of light, greater or leſs, according to the ſtrength and quantity of the materials. This opinion is certainly falſe; for it is impoſſible the vapours ſhould be attended with ſuch fiery particles as is here ſuppoſed: neither have we occaſion to fly to ſuch an hypotheſis; for as vapours, exhaled from the ſurface of the water, are carried up into the atmoſphere, in like manner the effluvia of ſolid bodies are continually aſcending thither. Now we find by experiment, that there are ſeveral inflammable bodies, which, being mixed together in due proportion, will kindle into flame by fermentation alone, without the help of any fiery particles.

Thus, M. Lemery having covered up, in the earth, about fifty pounds of a mixture, compoſed of equal parts of ſulphur and filings of iron, tempered with water; after eight or nine hours time the earth, where it was laid, vomited up flames. Thus alſo, mix a ſmall quantity of gun-powder with oil of cloves, pour gently upon this mixture two or three times as much ſpirit of nitre, and you will obſerve a bright inflammation ſuddenly ariſing from it. A mixture of the two fluids alone will take fire, the powder is added only to augment the inflammation. When, therefore, there happens to be a mixture of the effluvia of ſuch bodies floating in the air, they ferment, kindle, and, flaſhing like gun-powder, occaſion thoſe exploſions and ſtreams of fire, which we call thunder and lightning.

As to the particular ſpecies of the effluvia, which compoſe this mixture, that cannot be exactly determined: they are thought to be chiefly ſulphureous and nitrous; ſulphureous, becauſe of the ſulphureous ſmell which lightning generally leaves behind, and of that ſultry heat in the air, which is commonly the fore-runner of it; nitrous, becauſe we do not know of any body liable to ſo ſudden and violent an exploſion as nitre is.

Dr. Liſter is of opinion, that the matter both of thunder and lightning, and alſo of earthquakes, is the effluvia of the pyrites; as he does, that the matter of vulcanos is the pyrites itſelf. This is a mineral that emits copious exhalations, and is exceeding apt to take fire upon the admiſſion of moiſture. See the doctor's defence of his notion in the Phil. Tranſ. N° 157. He thinks this may be the reaſon why England is ſo little troubled with earthquakes, and Italy, and almoſt all places round the Mediterranean ſea, ſo very much, viz. becauſe the pyrites are rarely found in England; and, where they are, they lie very thin, in compariſon of what they do in thoſe countries; as the vaſt quantity of ſulphur emitted from the burning mountains there, ſeems to ſhew.

The effects of thunder and lightning are owing to the ſudden and violent agitation the air is put into thereby, together with the force of the exploſion; and not to thunderbolts falling from the clouds, as is ſuppoſed by the vulgar.

Some are inclined to think, that thunderbolts are artificial, and that they were applied by the antients to ſome uſe. What confirms them in their opinion is, that they are found more frequently where ſepulchres have been, than in other places.

The diſtance the thunder is from us, may nearly be eſtimated by the interval of time between our ſeeing the lightning and hearing the thunder; for as the motion of light is ſo very quick, that the time it takes up in coming to us from the cloud, is not perceptible; and as that of a ſound is about a thouſand feet in a ſecond; allowing a thouſand feet for every ſecond that paſſes between our ſeeing the one and hearing the other, we have the diſtance of the cloud, pretty nearly, from whence the thunder comes.

We ſometimes ſee flaſhes of lightning, though the ſky be clear and free from clouds; in this caſe they proceed from clouds that lie immediately below our horizon.

It has lately been found by repeated experiments that the electric matter, and that which produces thunder, are the ſame. We are beholden for this diſcovery to Mr. B. Franklin of Philadelphia.

THUNDERING LEGION, *Legio Fulminans*, was a legion in the Roman army, conſiſting of Chriſtian ſoldiers, who, in the expedition of the emperor Marcus Aurelius againſt the Sarmatæ, Quadi, and Marcomanni, ſaved the whole army then ready to periſh of thirſt, by procuring, with their prayers, a very plentiful ſhower thereon, and at the ſame time a furious hail, mixed with lightning and thunder-bolts, on the enemy.

This is the account commonly given by eccleſiaſtical hiſtorians, and the whole hiſtory is engraven in baſs-relievo's on the Antonine column. And hence aroſe the denomination Thunderers, though ſome ſay, that the legion thoſe Chriſtians were of, was called the Thundering Legion before.

THURSDAY, the fifth day of the Chriſtian week, but the ſixth of that of the Jews.

Holy THURSDAY, the ſame with Aſcenſion-day.

Maundy

Maundy THURSDAY. See the article MAUNDY-THURSDAY.

THUYA, *Arbor Vitæ*, in botany, a genus of plants, producing male and female flowers in the ſame plant; the male flowers are produced in an oval katkin, placed oppoſite upon the common foot-ſtalk, each flower embracing it with its baſe; theſe come out of an oval concave ſcale; they have no petals, but have four ſtamina, which are ſcarce diſcernible; their ſummits adhere to the baſe of the ſcale of the empalement. The female flowers are collected in a common almoſt oval cone, two flowers ſtanding oppoſite in each ſcale; they have no petals, but have a ſmall germen, ſupporting a ſlender ſtyle, crowned by a ſingle ſtigma; theſe are ſucceeded by an oblong oval cone, opening longitudinally, whoſe ſcales are almoſt equal, convex on the out-ſide, and obtuſe, each containing an oblong ſeed.

Mr. Miller enumerates two ſpecies of theſe plants: the firſt growing naturally in Canada, Siberia, and other northern countries; and in ſome of the Engliſh gardens which have not been altered, there are ſome of theſe trees which are of a large ſize: it has a ſtrong woody trunk, which riſes to the height of forty feet or more.

The ſecond ſort grows naturally in the northern parts of China, where it riſes to a conſiderable height; but this has not been long enough in Europe to have any trees of large ſize.

Theſe trees may be propagated by ſeeds, layers, or cuttings. The firſt ſort is commonly propagated by cuttings; theſe ſhould be planted in September, upon a ſhady border, and in a loamy ſoil; the cuttings ſhould be choſen from the ſhoots of the ſame year, with a ſmall joint of the former year's wood at the bottom of each. Theſe ſhould be planted three or four inches deep, in proportion to their length, treading the ground cloſe to them to prevent the admiſſion of air. If the following ſpring ſhould prove dry, there ſhould be a little mulch laid over the ſurface of the ground to prevent its drying; where this is performed in time, it will ſave the trouble of watering the cuttings; and it will be much better for them, becauſe when theſe are putting out their young fibres, if they are much watered, it will rot them while they are tender. Theſe cuttings will be rooted enough to tranſplant by the next autumn, when they may be either planted in beds, or in nurſery-rows to be trained up.

When they are propagated by layers, the young branches only ſhould be laid down in autumn, which will alſo put out roots by the next autumn, when they may be taken up, and tranſplanted in the ſame manner as thoſe raiſed from cuttings; but although theſe are very expeditious methods of propagating this tree, yet thoſe who are deſirous to have large trees, ſhould always propagate them by ſeeds, for the plants ſo raiſed will be much preferable to the other.

The China ſort is generally propagated by layers in the ſame way as the former, but the cuttings of this, if rightly managed, will take root very freely; but moſt people have over nurſed them. If theſe are planted in September in a border of ſoft loam, expoſed to the eaſt, and if before the hard froſts ſet in, the ſurface of the ground is covered with old tanners bark about two inches thick, it will prevent the froſt from penetrating the ground; and if this remains in the ſpring, it will alſo keep the ground moiſt, for if the cuttings or layers of this ſort are watered too much in the ſpring, when they are beginning to put out young fibres, it will certainly rot them; therefore it is moſt adviſable not to water theſe cuttings or layers, nor ſhould the plants be much watered when they are tranſplanted, for the ſame reaſon; but as there are many plants now in England, which ripen their ſeeds, ſo thoſe who can be ſupplied with them, ſhould prefer them to the other; for, after the firſt two years, the ſeedling plants will greatly outſtrip the other in growth, and the plants will be much handſomer.

Theſe ſeeds ſhould be ſown ſoon after they are ripe, which is in the ſpring. They ſhould be ſown in pots, filled with ſoft loamy earth, and plunged into the ground in an eaſt border, where they may have only the morning ſun, obſerving always to keep the pots clean from weeds. Sometimes theſe ſeeds will come up the ſame year, but they often lie in the ground till the next ſpring; therefore the pots ſhould be put in a common hot-bed frame in winter, and in the ſpring the plants will come up; theſe muſt not be too much expoſed to the ſun the firſt year, and if in the next winter they are ſheltered under a frame, it will be a good way to preſerve them; and the ſpring following they may be tranſplanted into beds, and treated in the ſame way as thoſe propagated by cuttings.

THYMALLUS, in ichthyology, the name of a fiſh, called in Engliſh the greyling or umber.

It is of a long flatted body, the belly is ſomewhat broad, and the back rigid and thin. It ſeldom exceeds a pound, or at the utmoſt a pound and a half weight. Its back is of a duſky browniſh green, with a ſomewhat bluiſh caſt intermixed, and its ſides of a more ſhining gloſs with an admixture of gold colour. The ſcales are of a ſort of rhomboidal form, and the ſide lines are much nearer the back than the belly. The ſides are variegated with black ſpots placed irregularly, but there are none of theſe near the tail. The back has two fins, and the tail is forked. The head is ſmall, the eyes large and protuberant; the mouth is moderately large, and the upper jaw larger than the under; it has no teeth, but the whole jaws are rough like a file.

It is caught in the freſh rivers in the mountainous counties of England, and in the like ſituations in Germany, and other kingdoms, and is one of the fineſt-taſted of all the freſh-water fiſh. It feeds on worms, and ſpawns in May.

THYMUS, thyme, in botany, a low ſhrubby plant, conſiſting of numerous ſlender tough ſtalks, with little roundiſh leaves in pairs, and looſe ſpikes, on the tops, of purpliſh or whitiſh labiated flowers, whoſe upper lip is nipt at the extremity, the lower divided into three nearly equal ſegments.

There are three different ſpecies of thyme enumerated in the materia medica: 1. Common thyme, with upright ſtalks, and dark browniſh green ſomewhat pointed leaves; a native of the ſouthern parts of Europe, common in our gardens, and flowering in June and July.

This herb is a moderately warm pungent aromatic. To water it imparts, by infuſion, its agreeable ſmell, but only a weak taſte, with a yellowiſh or brown colour: in diſtillation, it gives over an eſſential oil, in quantity about an ounce from thirty pounds of the herb in flower, of a gold yellow colour if diſtilled by a gentle fire, of a deep browniſh red if by a ſtrong one, of a penetrating ſmell reſembling that of the thyme itſelf, but leſs grateful, in taſte exceſſively hot and fiery: the remaining decoction, inſpiſſated, leaves a bitteriſh, roughiſh, ſubſaline extract. The active matter, which by water is only partially diſſolved, is by rectified ſpirit diſſolved completely, tho' the tincture, in colour blackiſh-green, diſcovers leſs of the ſmell of the thyme than the watery infuſion: the ſpirit brings over in diſtillation a part of its flavour, leaving an extract of a weak ſmell and of a penetrating camphorated pungency.

2. Mother-of-thyme, with trailing ſtalks, and obtuſe leaves: growing wild on heaths and dry paſture grounds. This alſo is an elegant aromatic plant, ſimilar to the foregoing ſpecies, but milder, and in flavour rather more grateful. Its eſſential oil is both in ſmaller quantity and leſs acrid, and its ſpirituous extract comes greatly ſhort of the penetrating warmth and pungency of that of the other. Both the leaves themſelves, and their ſpirituous tincture, are of a bright green colour, without any thing of the brown or blackiſh hue of thoſe of the common thyme.

3. Lemon-thyme, in appearance differing little from the ſecond ſort, except that it is more upright and more buſhy; a native of dry mountainous places, common in gardens, and flowering as the others in June or July. This ſpecies is leſs pungent than the firſt ſort, more ſo than the ſecond, and much more grateful than either: its ſmell in particular is remarkably different, approaching to that of lemons. Diſtilled wth water, it yields a larger quantity than the other ſorts, of a yellowiſh very fragrant oil of the lemon-flavour, containing nearly all the medicinal parts of the plant, for the remaining decoction

coction is almoſt inſipid as well as inodorous. It gives over alſo with rectified ſpirit its finer odorous matter; a leſs agreeable flavour, and a moderate warmth, remaining in the ſpirituous extract.

All theſe plants may be eaſily propagated by thoſe who are deſirous to have them in their gardens, either by ſlips, or by ſowing their ſeeds in the ſpring. They delight in dry undunged ground, where they will propagate themſelves by their trailing ſtalks, and require no other care but to keep them clean from weeds.

THYMUS, in anatomy, is that gland which in calves, lambs, and young animals, is called the ſweet-bread.

The thymus is an oblong glandular body, round on the upper-part, and divided below into two or three lobes, of which that towards the left-hand is the largeſt. In the fœtus, it is of a pretty large ſize, leſs in children, and very little in aged perſons. In children, it is of a white colour, ſometimes mixed with red; but, in an advanced age, its colour is generally dark.

The greateſt part of the thymus lies between the duplicature of the ſuperior and anterior portion of the mediaſtinum, and the great veſſels of the heart, from whence it reaches a little higher than the tops of the two pleuræ, ſo that ſome part of it is out of the cavity of the thorax; and in the fœtus, and in children, it lies as much without the thorax as within it.

Its particular inward ſtructure and ſecretions are not as yet ſufficiently known to determine its uſes, which however ſeem to be deſigned more for the fœtus than adults.

THYMUS, in medicine, is uſed for a kind of wart growing on the parts of generation, the fundament, and ſeveral other parts of the body.

The ordinary method of curing a thymus, is by ligature and deſiccative lotions, or by cauſtics; and if large, by inciſion, taking care firſt to ſecure the greater veſſels, by tying them.

THYNNUS, the name of a fiſh, called in Engliſh the tunny or Spaniſh mackarel, common in the Mediterranean, and other ſeas, and ſometimes, though not frequently, caught on the Engliſh coaſts.

It is a very large fiſh, growing ſometimes to ſeven or eight feet long, and more than an hundred weight. It is of a rounded and thick body, growing gradually ſmall towards the tail, until it is at length extremely ſlender. It very much reſembles the pelamis in its whole figure, but that it wants the oblong black ſtreaks which that fiſh has on its ſides, and is much larger. The back is black, or, if held in ſome lights, is of a ſhining bluiſh or greeniſh hue. Its belly and half its ſides are of a ſilvery whiteneſs. Its ſcales are very ſmall, its ſnout pointed, its jaws both of equal length, and armed each with one row of teeth. The mouth is large and black within, except that part of the palate is red. The eyes are large. The larger black fins are two in number; the foremoſt placed near the head, and riſing out of a cavity in the back, and the other at a ſmall diſtance behind that; and, in ſome fiſh of this ſpecies, of a reddiſh or yellowiſh colour; and, behind this laſt, there are eight, nine, or ten ſmall fins running down the ridge of the back, at equal diſtances to the tail. The tail is very forked. The fins at the gills are black, ſmall, and terminate in a point. The belly fins are placed but at a ſmall diſtance behind theſe, and are alſo ſmall; and both theſe, and the gill-fins, have ſinuſes in the body of the fiſh, into which they may be depreſſed. Behind the anus is a fin like that on the back, and behind it eight more ſmall ones, anſwering to thoſe on the back alſo; and the ſkin of the ſides, near the tail, is extended into two fins, ſo that this part of the fiſh looks in ſome ſort ſquare. It is a good fiſh for the table, and is ſalted in vaſt quantities in Spain and Italy.

THYROARYTÆNOIDES, in anatomy, a muſcle of the larynx, which, ariſing and terminating in it, ſerves, together with the arytenoides, to conſtringe it. Theſe two muſcles mutually interſect one another, and ſtraighten the glottis; ſometimes there is but one muſcle; and ſometimes it is different from that deſcribed here.

THYROIDE GLAND, in anatomy, is of a very ſingular figure, reſembling that of the new moon. It adheres by its middle part, which is called by authors its iſthmus, to the upper ring of the trachea, and its points or horns are turned upwards. It adheres on each part to the larynx and œſophagus.

THYROIDE CARTILAGE, one of the five cartilages that principally compoſe the larynx. The thyroide is the firſt of theſe cartilages, and is alſo called the ſcutiform cartilage, being of a quadrangular figure, and ſtanding in the anterior part, where the pomum Adami, as it is uſually called, makes its prominence, and the largeſt of the other five cartilages.

THYROSTAPHYLINUS, in anatomy, the name of a muſcle of the uvula, which ariſing from the lateral part of the thyroide cartilage, and aſcending towards the uva, becomes larger, and is inſerted in the manner of an arch, in the ſide of the velum palatinum.

THYRSUS, in antiquity, the ſceptre which the poets put into the hand of Bacchus, and wherewith they furniſhed the Menades in their Bacchanalia.

The thyrſus was originally a lance or ſpear wrapped up in vine-leaves, wherewith Bacchus is ſaid to have armed himſelf and his ſoldiers in the Indian wars, to amuſe and deceive the unpractiſed Indians, and make them expect no hoſtilities.

Hence, it was afterwards borne in the feaſts and ſacrifices of that god; and as the ſatyrs, who were Bacchus's ſoldiers, were ſuppoſed to have fought with it, it became a cuſtom to repreſent them therewith.

TIARA, an ornament or habit wherewith the ancient Perſians covered their head, and which the Armenians, and kings of Pontus, ſtill wear on medals; theſe laſt, becauſe deſcended from the Perſians.

TIARA is alſo the name of the pope's triple crown; anciently called regnum.

TIBERIADES WATER, the water of a hot ſpring near Tiberiades in Egypt. Dr. Perry, when on the ſpot, tried ſome experiments on this water, which give us a much better idea of its nature, than we have from any other accounts of it. Half a dram of tartar being mixed with an ounce and a half of the water, it becomes turbid and muddy; and, after twelve hours, three parts of the whole appear like white wool, only leaving a ſmall portion of clear water at the top. This white woolly matter, dried, produced only a ſmall quantity of yellow ochre.

Spirit of vitriol added to the water in the ſame quantity, affords a large unctuous ſediment of a white colour. A ſolution of ſublimate being mixed in the ſame quantity, it became turbid and yellowiſh, and yielded an earthy ſediment in a ſmall quantity; whence it ſeems evident, that it contains a ſal murale.

Saccharum ſaturni being added in the ſame quantity, the water depoſited a lateritious ſediment in a ſmall quantity. Mixed with ſpirit of ſal armoniac, it turns to a bluiſh green turbid liquor, and finally yields a woolly ſediment. Sugar of violets, mixed with it, turned it to a yellowiſh colour; and the ſcrapings of galls, mixed with it, turned it to a deep purple; and on ſhaking this became as black as ink.

It appears from theſe experiments, that the water contains a good deal of a groſs fixed vitriolic ſalt, ſome alum, and a ſal murale. It is too ſalt and nauſeous for internal uſe; but it muſt be of uſe as a bath in all cutaneous foulneſſes, eſpecially in ſcorbutic and leprous caſes; for it will powerfully deterge, ſcour, and cleanſe the excretory pores, and it may, by its weight and ſtimulus, reſtore them to their natural ſtate and tone, and reſtore the true ſtate of the vitiated ſolids in general. *Phil. Tranſ.* N°. 462.

TIBIA, in anatomy, is the inner and bigger bone of the leg, called alſo focile majus: it is hard and firm, with a cavity in its middle; it is almoſt triangular; its fore and ſharp edge is called the ſkin. In its upper extremity it has two large ſinuſes, tipped with a ſoft and ſubtle cartilage, called cartilago lunata, from its figure. It runs in between the extremities of the two bones, and becomes very thin at its edge, like thoſe in the articulation of the lower jaw. It facilitates a ſmall ſide

motion of the knee. The ſinuſes receive the two protuberances of the thigh-bone, and the production which is between the ſinuſes of the tibia, is received in the ſinus which divides theſe two protuberances of the femur. By bending our knee, we bring our leg, in walking, in a ſtraight line forwards, which, without this articulation, we could not have done: but, like thoſe who have the misfortune to have a wooden leg, we muſt have brought our foot about in a ſemi-circle, in going even upon a plain, but more evidently upon a deſcent. On the ſide of this upper end it has a ſmall knob, which is received into a ſmall ſinus of the fibula; and, on its fore part, a little below the patella, it has another, into which the tendons of the extenſors of the leg are inſerted. Its lower extremity, which is much ſmaller than its upper, has a remarkable proceſs which forms the inner ancle, and a pretty large ſinus divided in the middle of a ſmall protuberance; the ſinus receives the convex head of the ſame bone. It has another ſhallow ſinus in the ſide of its lower end, which receives the fibula.

TIBIALIS, or TIBIÆUS, in anatomy, the name of two muſcles of the foot, diſtinguiſhed by the epithets anticus and poſticus. The tibialis anticus, one of the flexor muſcles, has its origin from the ſuperior and tenſor ſurface of the tibia, and is terminated at the external os cuneiforme, and the interior part of the internal metatarſal bone. The tibialis poſticus, or adductor muſcle of the foot, has its origin in the upper part of the interoſſeous ligament, and its termination in the os naviculare.

TICKLING, ſays M. le Cat, is, in reſpect to the ſenſe of feeling, what an hermaphrodite is in reſpect to ſexes: it partakes equally almoſt of pleaſure and pain; making one laugh, at the ſame time that it is intolerable; and if carried too far, frequently has bad and even fatal effects. In this ſenſation, the organs of feeling are affected with a light tremulous motion, which occaſions all voluptuous ſenſations; but more lively in its degree and ſmarter than that which uſually attends on pleaſure: it proceeds from that gentle friction, which is diſtinguiſhed from all other impreſſions on the organs, by the name of titillation.

TICKLISH, in the manege. A horſe is ſaid to be tickliſh, that is too tender upon the ſpur, and too ſenſible; that does not freely fly the ſpurs, but in ſome meaſure reſiſts them, throwing himſelf up, when they come near and prick his ſkin. A tickliſh horſe has ſomewhat of the ramingues, i. e. the kickers againſt the ſpurs; but with this difference, that the latter put back, leap and kick, and yerk out behind, in diſobeying the ſpurs; whereas a tickliſh horſe only reſiſts for ſome time, and afterwards obeys and goes much better, through the fear of a vigorous ham, when he finds the horſeman ſtretch his leg, than he does upon being actually pricked.

TIDES, two periodical motions of the waters of the ſea, called the flux and reflux, or the flow and ebb.

The caſe of the tides is the attraction of the ſun and moon, but chiefly of the latter; the waters of the immenſe ocean, forgetful, as it were, of their natural quietus, move and roll in tides, obſequious to the ſtrong attractive power of the moon, and weaker influence of the ſun.

To illuſtrate this, let N E S Q (plate CXXVI. *fig.* 6.) repreſent the earth covered over with water A B D F; N S the axis of the earth, E Q the equator, T R the tropic of cancer, *t r* the tropic of capricorn, M the moon in her orbit, S the ſun in his. Now ſince all bodies are endued with an attracting virtue, the moon will attract all the water in the neareſt hemiſphere F A B, with degrees of force which are inverſely as the ſquares of the diſtances from all parts; and therefore with the ſtrongeſt force where the diſtance is leaſt, viz. in the point A, directly under her: and this attraction being in this hemiſphere contrary to that of the earth, the water in all parts from B to F towards A will have its gravity decreaſing, and be higheſt of all at the part A; and conſequently muſt there ſtand higher than at the point F, where being more attracted by the earth, it muſt be heavier and nearer to the center, as is evident from the laws of hydroſtatics. See the article FLUID.

Again, in the hemiſphere F D B, the attraction of the moon conſpires with that of the earth; but decreaſing as the ſquares of the diſtances increaſe, the joint force of attraction will every where decreaſe from F and B towards D, the point oppoſite to the moon; where, again the waters will be lighteſt, and therefore ſtand higheſt to preſerve the equilibrium. Whence it appears, that by this ſum and difference of the moon's and earth's attraction, there will neceſſarily enſue a protuberance or ſwelling of the waters, which we call tides of flood, in the two points A and D directly under the moon. Alſo in the two points F and B, as the waters are there moſt attracted, ſo they will be heavieſt, and conſequently riſe to the leaſt height from the earth's ſurface, whence they are called tides of ebb, or the ebbing of the water.

If to the power of the moon we add that of the ſun, we ſhall have the tides conſiderably augmented at the conjunction in S, or oppoſition in H, that is, at the new and full moons, which are called the ſpring-tides; as thoſe which happen when the ſun is at O or P, are called neap-tides, the waters at A and D being then loweſt, becauſe the attraction of the moon is then counterballanced by that of the ſun.

It is farther to be obſerved, that of the two tides of flood at A and D, that at A is greateſt to any place T in northern latitude, when the moon is in the northern ſigns and above the horizon; for the point A is then nearer the zenith of the place G, than the oppoſite point D is to the ſame place at R twelve hours afterwards; and, conſequently, the height of the tide T G is greater than that of the oppoſite tide R *g*. The contrary of this happens, when the moon is in the ſouthern ſigns.

That there are two tides of flood and two of ebb, ſucceeding each other alternately at about the interval of ſix hours, is obvious from the figure; and that they happen later each day near an hour, is owing to their exact correſpondence to the motion of the moon, which daily culminates ſo much later. That they happen not when the moon is in the meridian, but about three hours after, is owing to the force of the moon being then greater than when in the meridian of any place; as the heat of the day is greater at three o'clock than at twelve; and the heat of the ſummer is greater in Auguſt, than at the 21ſt of June. Laſtly, that the greateſt ſpring-tides happen not at the 21ſt of March, and 23d of September, but in February and October, is becauſe the ſun being neareſt the earth in December, his influence is then ſtrongeſt, and ſo muſt quicken the time of the greateſt vernal tides; and being weakeſt in June, the time of the autumnal tides will neceſſarily be retarded.

The ſum of what has been ſaid is this: if N O P Q (*fig.* 7.) be the ſurface of the earth T its center, I F K G L H C E a circle repreſenting the ſpherical ſurface of the waters covering the earth and affected only by the attractive power of the earth; upon placing an attracting body at S, the waters will no longer continue their ſpherical figure, but be immediately drawn into the ſpheroidical figure A C B D, in ſuch manner, as to be depreſſed at C and D to M and K, and elevated from L and I to A and B; and the elevation A L or B I, is double the depreſſion C M or D K. That if S be the ſun, then A P − O K = A L + K D = 25 inches; or 11$\frac{1}{2}$ feet, if S be the moon. That at the points E, F, G, H, (which are called the octants) the water is neither elevated nor depreſſed. That if any other body be placed at O, as the moon, in the ſame right-line T S; then by the joint influence of both S and O, the elevation at A and B will be increaſed, and the depreſſion at C and D likewiſe. Laſtly, if S be in the ſituation *S*, or vertical to the point D, it is plain its action to raiſe the water D will be directly contrary to that of the moon in depreſſing it there; wherefore the depreſſion will not be ſo great as before; for the ſame reaſon the elevation at A and B will be diminiſhed, being now only as the difference of the two forces, whereas before they were as the ſum.

We ſhall now conſider the phænomena of the tides which remain; and firſt, it is evident, that if P N be the axis of the earth, and Q O the diameter of the equator, then the moon ſituated at O, over one of the poles, would accumulate the water over each pole, and the

ſpheroid

Fig. 1. Theodolite.

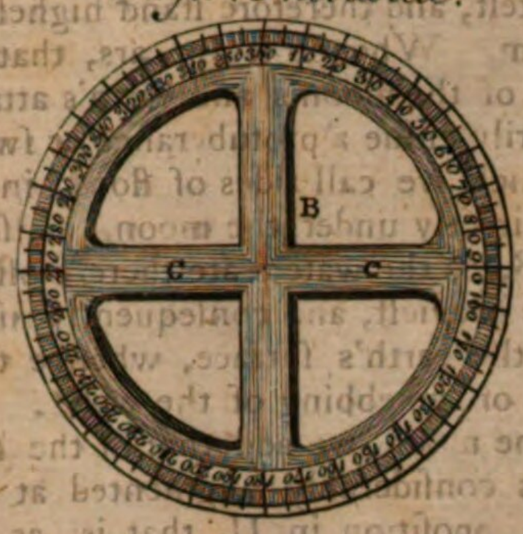


Fig. 2.

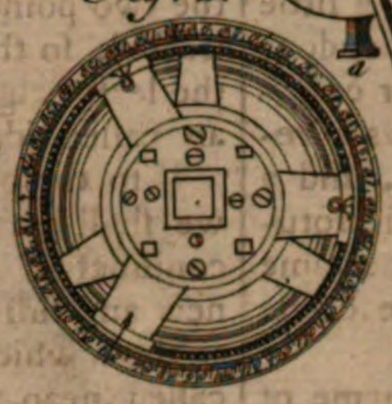


Fig. 3.

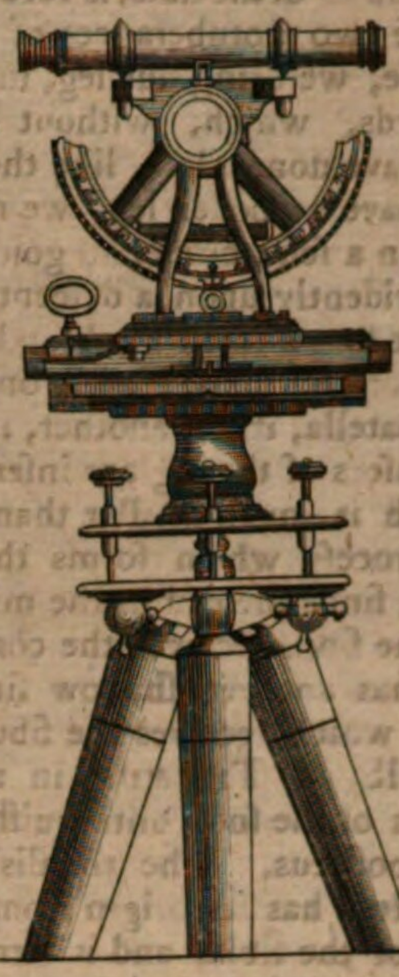


Fig. 4.

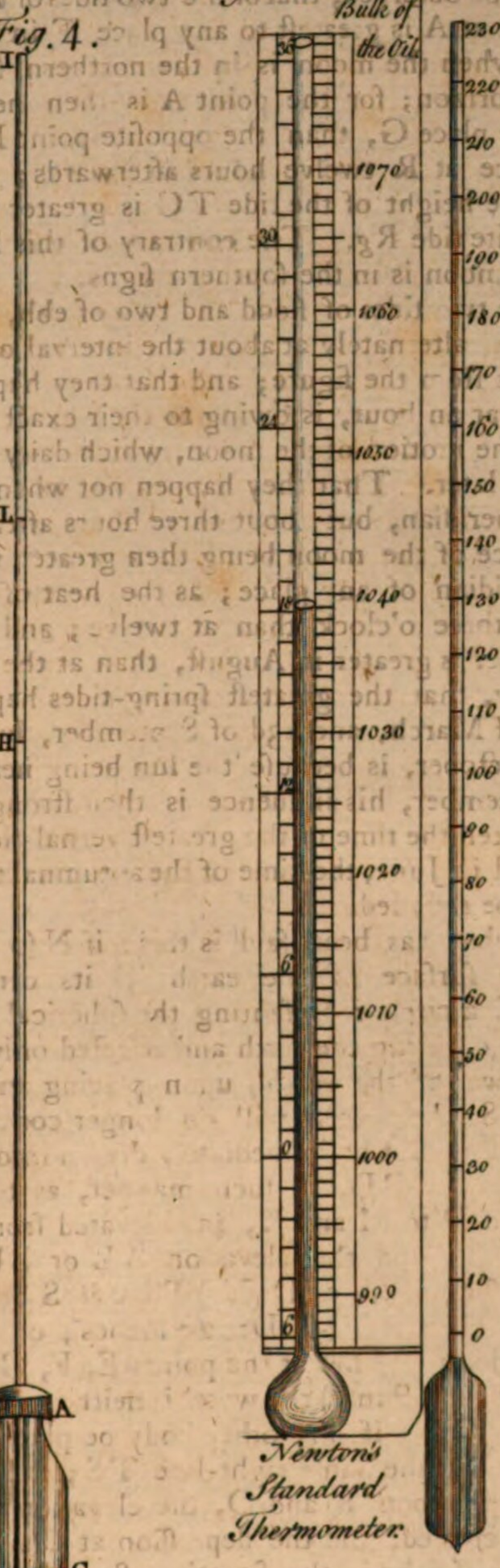


Fig. 5. Thermometer.

Tides.

Fig. 6.

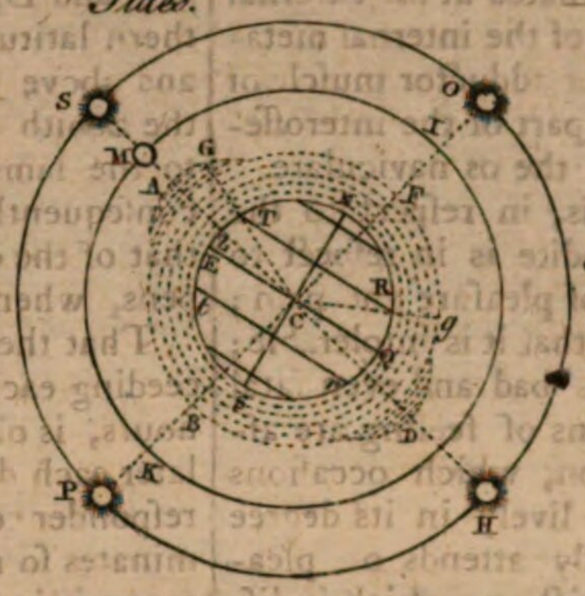


Fig. 7.

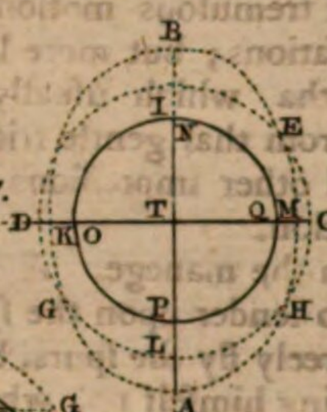


Fig. 8.

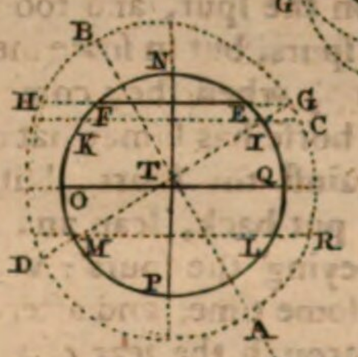


Fig. 9.

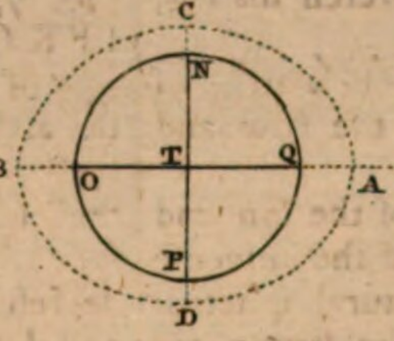


Fig 10

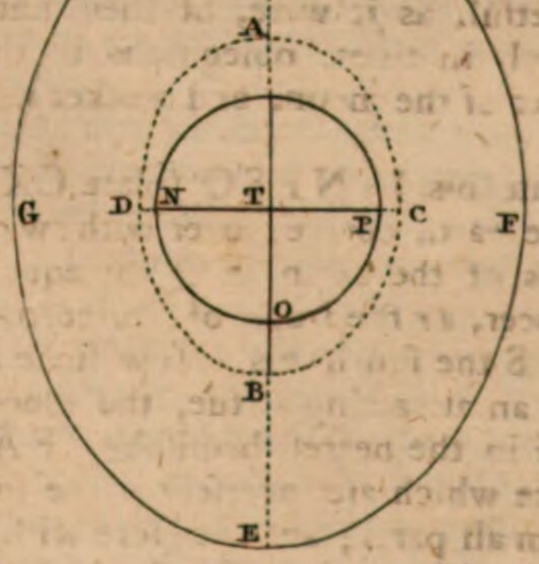


Fig. 11.

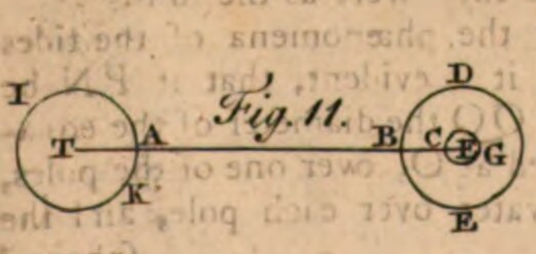


Fig. 12. Strength of Timber.

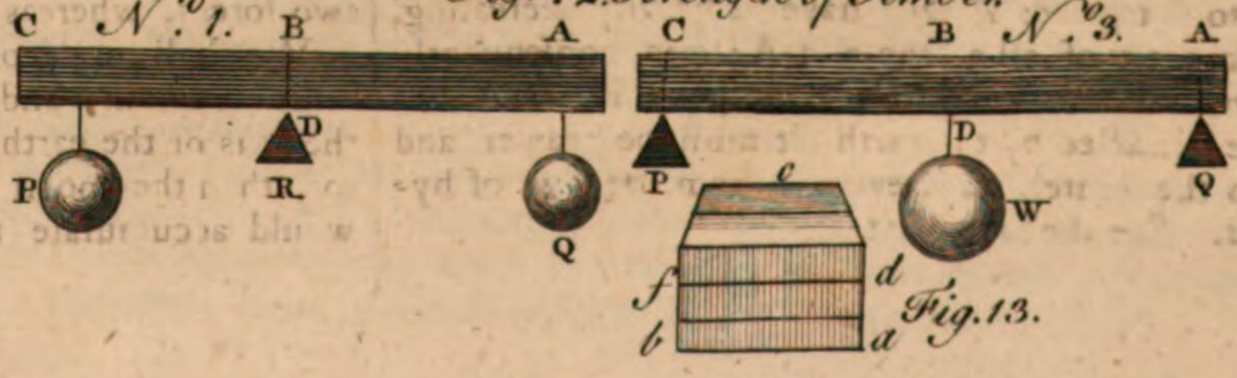


Fig. 13.

spheroid would be so pulled as to have its longest axis A B coinciding with the axis of the earth P N. In this position of the spheroid, it is plain, there could be no such thing as a tide in any part of the ocean over all the earth; for every section of the spheroid, parallel to the equator, would be a circle; consequently in any parallel of latitude, the water would be at an equal distance from the earth's surface every moment of the diurnal revolution, or natural day.

Suppose the moon were removed from the direction of the earth's axis, and pulled to S (fig. 8.) then will the axis of the aqueous spheroid A B be turned towards S, and make an angle with the earth's axis, as A T P or B T N. Then we observe, that three C, D, are the places of lowest water, that parallel I K which passes through the point I on one side the equator, and L M which passes through M on the other, will divide the earth into three zones, in two of which, viz. E N K and L P M, there will be put one tide each day, of the same kind; for instance, in the parallel E F, a portion at F will have high water, and at E low water for twelve hours after. Again, in all the zone K M L, there will be two sides of the same kind each day, as is evident from the figure. These limits, or the arch Q I or Q M, is the complement of the moon's declination from the equator.

If the moon at S (fig. 9.) be over the equator, the zone or axis of the spheroid A B will now coincide with the plane of the equator Q Q, and the shorter axis C D with the axis of the earth N P. Here it is obvious, that in this situation of the spheroid, the waters in the parts A B, with respect to the axis at C D, will give the greatest difference of high and low water possible to all parts of the earth; and that there is no place but those two at the poles, N, P, that what two tides of flood, and two of ebb every twenty-four hours. And this difference of the flux and reflux will decrease from the equator to the poles.

It has been already observed, that the greatest elevation of the waters is not when the luminary is in the meridian, but about three hours after, because the motion communicated to the waters during the arrival of the meridian is not immediately destroyed, but remains some time, and receives a further augmentation from that which is impelled for about three hours after. For the same reason, we observe, the greatest and least tides happen not on the day of the syzygy, or quadrature, but on the second or fourth after; the sum or difference of the forces of the luminaries not being till then at a maximum. See the article SYZYGY.

Let S P E G (fig. 10.) be the orbit of the moon about the earth Q N C P, which as is is not circular but elliptical, the center of the earth T will not be always at an equal distance from the moon, but the moon will be sometimes nearer the earth, when at S, and sometimes farther off, as at E. The point S is called the perigeum, or perigee; and the point E the apogeum, or apogee. The power of the moon in her perigee is to that in the apogee nearly as T E 2 to T S 2, and consequently the greatest tides will be on the day of the perigee, or rather a few days after, for the reasons above-mentioned. Such would the tides regularly be, if the whole earth were covered with deep sea; but by reason of the shallows of some places, and the narrowness of the straights, by which the tides are in many places propagated, there arises a great diversity in the tides not to be accounted for without an exact knowledge of all the circumstances of the several places where they happen; as of the position of the land, the breadth and depth of channels, &c.

That the tides may have their full motion, the ocean in which they are produced ought to be extended from east to west 90°, or a quarter of a great circle of the earth, at least; because the places where the moon rises most, and most deprelles the waters, are at that distance from one another. Hence it appears, that it is only in the great oceans that such tides can be produced; and that, in the large Pacific ocean, they exceed those in the Atlantic ocean: hence also it is obvious, why the tides are not so great in the torrid zone, between Africa and America, where the ocean is narrower, as in

ſpheroid would be ſo poſited as to have its longeſt axis A B coinciding with the axis of the earth P N. In this poſition of the ſpheroid, it is plain, there could be no ſuch thing as a tide in any part of the ocean over all the earth: for every ſection of the ſpheroid, parallel to the equator, would be a circle; conſequently in any parallel of latitude, the water would be at an equal diſtance from the earth's ſurface every moment of the diurnal revolution, or natural day.

Suppoſe the moon were removed from the direction of the earth's axis, and poſited at S (*fig.* 8.) then will the axis of the aqueous ſpheroid A B be turned towards S, and make an angle with the earth's axis, as A T P or B T N. Then we obſerve, that ſince C, D, are the places of loweſt water, that parallel I K which paſſes through the point I on one ſide the equator, and L M which paſſes through M on the other, will divide the earth into three zones, in two of which, viz. E N K and L P M, there will be put one tide each day, of the ſame kind; for inſtance, in the parallel E F, a perſon at F will have high water, and at E low water for twelve hours after. Again, in all the zone I K M L, there will be two tides of the ſame kind each day, as is evident from the figure. Theſe limits, or the arch Q I or O M, is the complement of the moon's declination from the equator.

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It has been already obſerved, that the greateſt elevation of the waters is not when the luminary is in the meridian, but about three hours after, becauſe the motion communicated to the waters during the arrival of the meridian is not immediately deſtroyed, but remains ſome time, and receives a farther augmentation from that which is impreſſed for about three hours after. For the ſame reaſon, we obſerve, the greateſt and leaſt tides happen not on the day of the ſyzygy, or quadrature, but on the third or fourth after; the ſum or difference of the forces of the luminaries not being till then at a maximum. See the article SYZYGY.

Let S F E G (*fig.* 10) be the orbit of the moon about the earth Q N O P, which as it is not circular but elliptical, the center of the earth T will not be always at an equal diſtance from the moon; but the moon will be ſometimes neareſt the earth, as when at S, and ſometimes fartheſt off, as at E. The point S is called the perigæum, or perigee; and the point E the apogæum, or apogee. The power of the moon in her perigee is to that in the apogee nearly as TE^3 to TS^3; and conſequently the greateſt tides will be on the day of the perigee, or rather a few days after, for the reaſons abovementioned. Such would the tides regularly be, if the whole earth were covered with deep ſea; but by reaſon of the ſhoalneſs of ſome places, and the narrowneſs of the ſtreights, by which the tides are, in many places, propagated, there ariſes a great diverſity in the tides not to be accounted for without an exact knowledge of all the circumſtances of the ſeveral places where they happen; as of the poſition of the land, the breadth and depth of channels, &c.

That the tides may have their full motion, the ocean in which they are produced ought to be extended from eaſt to weſt 90°, or a quarter of a great circle of the earth, at leaſt; becauſe the places where the moon raiſes moſt, and moſt depreſſes the water, are at that diſtance from one another. Hence it appears, that it is only in the great oceans that ſuch tides can be produced; and why, in the large Pacific ocean, they exceed thoſe in the Atlantic ocean: hence alſo it is obvious, why the tides are not ſo great in the torrid zone, between Africa and America, where the ocean is narrower, as in the temperate zones on either ſide; and from this alſo, we may underſtand why the tides are ſo ſmall in iſlands, that are very far diſtant from the ſhores. It is manifeſt, that, in the Atlantic ocean, the water cannot riſe on one ſhore but by deſcending on the other; ſo that, at the intermediate diſtant iſlands, it muſt continue at about a mean height betwixt its elevation on the one and on the other ſhore.

As the tides paſs over ſhoals, and run through ſtreights into bays of the ſea, their motion becomes more various, and their height depends on a great many circumſtances. The tide, that is produced on the weſtern coaſt of Europe, correſponds to the theory above deſcribed: thus, it is high water on the coaſt of Spain, Portugal, and the weſt of Ireland, about the third hour after the moon has paſſed the meridian: from thence it flows into the adjacent channels, as it finds the eaſieſt paſſage. One current from it, for example, runs up by the ſouth of England, and another comes in by the north of Scotland: they take a conſiderable time to move all this way, and it is high-water ſooner in the places to which they firſt come; and it begins to fall at thoſe places, while the two currents are yet going on to others that are farther in their courſe. As they return, they are not able to raiſe a tide; becauſe the water runs faſter off than it returns, till, by a new tide propagated from the ocean, the return of the current is ſtopped, and the water begins to riſe again. The tide takes twelve hours to come from the ocean to London-bridge, ſo that, when it is high water there, a new tide is already come to its height in the ocean; and, in ſome intermediate place, it muſt be low water at the ſame time. In channels, therefore, and narrow ſeas, the progreſs of the tides may be, in ſome reſpects, compared to the motion of the waves of the ſea. Our author alſo obſerves, that when the tide runs over ſhoals, and flows upon flat ſhores, the water is raiſed to a greater height than in the open and deep oceans that have ſteep banks; becauſe the force of its motion cannot be broke, upon theſe level ſhores, till the water riſes to a greater height.

If a place communicates with two oceans, or two different ways with the ſame ocean, one of which is a readier and eaſier paſſage, two tides may arrive at that place in different times, which, interfering with each other, may produce a great variety of phænomena. An extraordinary inſtance of this kind is mentioned by our author at Bathſha, a port in the kingdom of Tunquin in the Eaſt-Indies, of northern latitude 20° 50′. The day in which the moon paſſes the equator, the water ſtagnates there without any motion: as the moon removes from the equator, the water begins to riſe and fall once a day; and it is high water at the ſetting of the moon, and low water at her riſing. This daily tide increaſes for about ſeven or eight days, and then decreaſes for as many days by the ſame degrees, till this motion ceaſes when the moon has returned to the equator. When ſhe has paſſed the equator, and declines towards the ſouth pole, the water riſes and falls again, as before; but it is high water now at the riſing, and low water at the ſetting, of the moon.

This theory of tides has been extended ſo far, as to eſtimate the tides, or elevations of the waters of the moon, produced by the attraction of the earth: thus, let us ſuppoſe the quantity of matter, Q, in the earth to be to that in the moon, q, as 40 to 1, that is, $Q : q :: 40 : 1$; and let us firſt ſuppoſe the earth and moon of equal bulk, and repreſented by A I K, *fig.* 11. and B D E, and the force, F, of the earth, at the ſurface of the moon B, will be to the force, f, of the moon at the ſurface of the earth, A, directly as the maſſes of matter in each, becauſe of the equal diſtances T B and L A, that is, $F : f :: Q : q :: 40 : 1$. Again, let L B be to L C as the diameter of the earth to that of the moon, which is as 365 to 100, then will the force at B be to the force at C as L B to L C, which let be as F to f, then $F : f :: 365 : 100$, whence $F = \frac{365f}{100}$; and above we have $F = 40f$, therefore $4000f = 365f$; and ſo $f : f :: 365 : 4000 :: 1 : 11$ nearly; that is, the power of the earth to raiſe the water at the moon C, is to that of the moon at the earth A as 11 to 1, very nearly.

If the moon can raiſe the water here 10 feet, the earth can raiſe the water there to the height of 110 feet; but becauſe the moon always turns about her axis in the ſame time as ſhe revolves about the earth, the waters, if any there be, will be raiſed on this and the oppoſite ſide, and always continue over the ſame part of the moon's ſurface, ſo that there can be no different heights of water there, and conſequently no tides, except what ſmall ones may happen on account of the ſun's attraction, and her various inequalities of motion, and diſtance from the earth.

The air, which is 860 times lighter than water, muſt yield in proportion more eaſily to the attracting force of the ſun and moon; and therefore the tides will in this profound and vaſt aërial ocean be very conſiderable and important.

TIDE-WAITERS, or TIDESMEN, are inferior officers belonging to the cuſtom-houſe, whoſe employment it is to watch or attend upon ſhips, until the cuſtoms be paid: they get this name from their going on board ſhips, on their arrival in the mouth of the Thames or other port, and ſo come up with the tide.

TIERCE, or TEIRCE, a meaſure of liquid things, as wine, oil, &c. containing the third part of a pipe, or forty-two gallons.

TIERCED, *tierce*, in heraldry, denotes the ſhield to be divided by any of the partition-lines, as party, coupy, tranchy, or tailly, into three equal parts of different colours or metals.

TIGE, in architecture, a French term for the ſhaft or fuſt of a column, comprehended between the aſtragal and the capital.

TIGER, or TYGER, *Tygris*, in zoology, makes a diſtinct genus of the quadruped claſs of animals: it has four paps placed near the navel, and its feet are adapted to climbing. Linnæus takes in the panther to this genus, and diſtinguiſhes the tyger by the name of tygris maculis oblongis, and the panther by that of tygris maculis orbiculatis.

The tyger has its name from its ſuppoſed ſwiftneſs, and has been deſcribed by almoſt all authors as one of the ſwifteſt of all the wild carnivorous animals; but this has been wholly contradicted by ſuch authors as have ſeen the creature, who all declare that it is a ſlow and ſluggiſh animal, and is unable to overtake a man, or almoſt any animal that has an opportunity of running away from it. It will give two or three large leaps; but, if it do not ſeize its prey in theſe, is but ill qualified to catch it afterwards. *Ray's Syn. Quad.*

It exceeds the lion in ſize, and is of an unconquerable fierceneſs. It agrees with the panther in the variegation of its colours, but differs in the diſpoſition of them; for in the panther the colours are diſpoſed in round ſpots or eyes, and in the tyger they are diſpoſed in long ſtreaks.

The tyger is found in the Eaſt-Indies, in many parts of Aſia, and in America; but there ſeems ſome difference in ſpecies between the Aſiatic and American tygers; and poſſibly fuller obſervation may prove, that the Aſiatic are ſwift as the ancients have deſcribed them, and the American ones, of the ſlowneſs of which we have accounts, may be a different ſpecies.

The manner of carrying off the young brood of this animal is deſcribed by Pliny as follows: The Hircanians and Indians bring up the tyger, ſays he, an animal of a dreadful ſwiftneſs, which is moſt put to the proof, when going to be taken. The whole brood, which is always very numerous, is carried off upon a horſe, as ſwift as poſſible, and often removed to a freſh one. When the mother tyger finds the neſt empty, and the brood gone, for the males take no care of them, ſhe traces the ſcent with furious ſpeed; and when ſhe is arrived within hearing of the perſon who is carrying off her young, he throws down one of them; this ſhe takes up in her mouth, and, as if made more ſwift by the load, carries it back, and then, returning, is treated in the ſame manner till the perſon gets on board a ſhip, and leaves her to vent her rage on the ſhore.

TIGER-SHELL, a beautiful ſpecies of voluta, of a dusky red colour, ſpotted all over with large irregular blotches of white: it is brought from the Eaſt Indies,

and is about two inches and a half in length, and about an inch in diameter.

TILE, or TYLE, among builders. See the article TYLE.

TILIA, the lime-tree, in botany, a genus of plants, the corolla of which conſiſts of five oblong and obtuſe petals, crenated at the points: the fruit is a coriaceous, globoſe, quinquelocular capſule, containing a ſingle roundiſh ſeed in each. However, one ſeed only of the five uſually ripens, and the very cells of the others often diſappear, ſo that the fruit ſeems unilocular.

Mr. Miller enumerates four ſorts of lime-trees: however, he ſays all of them may be eaſily propagated by layers, which in one year will take good root, and may then be taken off, and planted in a nurſery, at four feet diſtance row from row, and two feet aſunder in the rows. The beſt time to lay them down, and to remove them, is when their leaves begin to fall, that they may take root before the froſt comes on, though they may be tranſplanted any time from September to March, in open weather; but if the ſoil is dry, it is much the better way to remove them in autumn, becauſe it will ſave a great expence in watering, eſpecially if the ſpring ſhould prove dry. In this nurſery they may remain four or five years, during which time the ground ſhould be dug every ſpring, and conſtantly kept clear from weeds, and the large ſide roots pruned off, to cauſe them to advance in height; but the ſmall twigs muſt not be pruned off from the ſtems, becauſe theſe are abſolutely neceſſary to detain the ſap, for the augmentation of their trunks, which are apt to ſhoot up too ſlender, when they are entirely diveſted of all their lateral twigs. If the ſoil in which they are planted, be a fat loam, they will make a prodigious progreſs in their growth, ſo that in three years time they will be fit to tranſplant out where they are to remain.

They may alſo be propagated by cuttings; but as this method is not ſo certain as by layers, the other is generally practiſed. In order to obtain proper ſhoots for laying down, a lime-tree is cut down cloſe to the ground, from the roots of which a great number of ſtrong ſhoots are produced the following year; theſe will be large enough to lay down the following autumn, eſpecially if the ſmalleſt of them are cut off cloſe early in the ſummer; for when too many ſhoots are ſuffered to grow all the ſummer, they will be much weaker, than if only a ſufficient quantity is left.

There are ſome perſons who raiſe theſe trees from ſeeds, which, although it is a ſlower way, yet when the trees are deſigned to grow large, is the beſt method; and if they are only once tranſplanted, are ſhorter lived than thoſe which remain in the places where they aroſe from the ſeeds, and their timber will be ſounder, and grow to a much larger ſize.

When this method is practiſed, the ſeeds ſhould be ſown in autumn, ſoon after they are ripe, upon a ſhady border of moiſt light ſoil, where the plants will come up the following ſpring; but, when the ſeeds are kept out of the ground till ſpring, the plants will not come up till the year after. When the plants appear, they ſhould be conſtantly kept clean from weeds till the following autumn; then they ſhould be carefully taken up, and tranſplanted into a nurſery, where they may grow two or three years to get ſtrength, and then they may be planted where they are deſigned to remain; for the younger they are planted out the more they will thrive.

The timber of the lime-tree is uſed by the carvers, it being a ſoft light wood, as alſo by architects for framing the models of their buildings; the turners likewiſe uſe it for making light bowls, diſhes, &c. but it is too ſoft for any ſtrong purpoſes.

Theſe trees will continue growing, and remain ſound a great number of years, and, if planted in a good loamy ſoil, will grow to a conſiderable bulk. Mr. Miller ſays he meaſured one of thoſe trees, which was near ten yards in girth, two feet above the ground, and was then in a thriving condition; and Sir Thomas Brown mentions one of theſe trees which grew in Norfolk, that was ſixteen yards in circuit, a foot and a half above the ground, in height thirty yards, and in the leaſt part of the trunk it was eight yards and a half.

TILLER, in husbandry, denotes a young tree, left to grow till it be fellable for timber.

TILLER *of a Ship*, a strong piece of wood fastened in the head of the rudder, and in small ships and boats called the helm.

In ships of war, and other large vessels, the tiller is fastened to the rudder in the gun room; and to the other end there are ropes fastened, which pass upwards to the quarter-deck, where the ship is steered by means of a wheel.

TILLAGE, in husbandry, is the opening, breaking, and dividing the ground by the spade, the plough, the hoe, or other like instruments.

The finer any land is made by tillage, the richer it will become, and the more plants it will maintain; and it has been frequently observed, that in a large field, where at some time one part of the ground has been better tilled than the rest, that part of the ground has produced the best crops, and been easily distinguished by it from the rest of the field, even six or seven crops after the time of the particular good tillage. A piece of ground being once made finer than the rest, will a long time shew the advantage of it; because the dews have more power to enrich it, they penetrating farther than the superficies, whereby the roots are able to enter. The fine parts of the earth are impregnated throughout their whole substance with some of the riches carried in by the dews, and there deposited until, by tillage, the inside of those fine parts become superficies; and as the corn drains them, they are again supplied as before; but the rough large parts cannot have that benefit, and the dews not penetrating but to their surface, they remain poor. The experiments mentioned by Mr. Evelyn, prove this beyond contest. Take of the most barren earth you can find, powder it well, and expose it abroad for a year, incessantly agitating it; and after this without any other management, this earth will be the most fertile that can be conceived, and will readily receive any plant from the fartheſt Indies: all vegetables will prosper and flourish in this once barren earth, and bear their fruit as kindly with us, under a due degree of artificial heat, as in their native climates.

The artificial dust will entertain plants which refuse dung and other violent applications, and has a more nutritive power than any artificial dung or compost whatsoever: and by this pulverising and exposing, the very nature of a soil may be changed, and the tougheſt clay made as light and friable as common light earth, and as fit for the nourishment of the tendereſt plants as any other; though, in its natural condition, its pores were too small to give way to their tender roots, and had no communication one with another.

This is a sort of improvement of land that cannot be practised in the large way, in fields, &c. but as it only consists in dividing and breaking the particles of earth, and exposing them thus broken to the air, it is plain that common tillage approaches more or less to it, as more or less labour is employed; and the experiment proves, that the farmer need never fear bestowing too much tillage on any sort of ground.

TILT-BOAT, a boat covered with a tilt; that is, a cloth or tarpawling, sustained by hoops, for the sheltering of passengers.

TIMAR, a tract or portion of land, which the grand seignior grants to a person on condition of serving him in war on horse-back. Hence, those who enjoy such lands, are called timariots; who besides the above-mentioned service, pay an acknowledgment of one tenth of their revenue.

TIMBER includes all kinds of felled and seasoned woods used in the several parts of building, as carpentry, joinery, turnery, &c.

The sorts of timber are numerous; we shall only mention some of the most usual from Evelyn's Sylva, &c. —as, 1. Oak, the uses of which need no enumerating: to endure all seasons and weathers, there is no wood like it; hence its use in building ships, in posts, rails, &c. For water-works it is second to none, and where it lies exposed both to air and water, there is none equal to it.

2. Elm. This felled between November and February is all spine or heart, and no sap, and is of singular use in places where it is always wet or dry; its being tough makes it useful to wheel-wrights, mill-wrights, &c. and its not being liable to break and fly in chips, makes it fit for dressers and planks to chop on.

3. Beech: its chief use is in turnery, joinery, and upholstery, and the like, as being of a white, fine grain, and not apt to bend or slit. Of late it is used for building timber; and if it lie constantly wet, is judged to outlast oak.

4. Ash: its use is almost universal; it is good for building where it may lie dry. It serves the carpenter, cooper, turner, plough-wright, wheel-wright, gardener, and at sea for oars, handspikes, and many other uses.

5. Fir, commonly known by the name of deal, is of late much used in building, especially within doors, for stairs, floors, wainscot, and most works of ornament.

6. Walnut-tree is of universal use, unless for the outsides of buildings; very fit for the joiner's use, being of a more curious brown-colour than beech, and less subject to worms.

7. Chesnut-tree, next to oak, is the timber most sought for by joiners and carpenters; it is very lasting.

8. Service-tree, used in joinery, as being of a delicate grain, and fit for curiosities: it also yields beams of considerable bigness for building.

9. Poplar, abel: this and aspen differing very little in their nature, are of late much used instead of fir; they look as well, and are more tough and hard.

10. Alder, much used for sewers, or pipes, to convey water; when always wet, it grows hard like a stone, but soon rots, if it is alternately wet and dry.

The uses of timber are so many and so great, that the procuring a sufficient supply of it extremely well deserves the care of every state, as it must be a great disadvantage to it to be obliged to have recourse to its neighbours, and purchase, at a very considerable and continually renewed expence, what might, by an easy œconomy, be sufficiently supplied at home.

This œconomy, however, must be applied in time; for natural indolence, our love to reap the advantages of every thing ourselves, and our little care for posterity, give great room to fear succeeding ages will want wood, both for private and public exigencies. All our art should be employed on this subject with two views; the one, to preserve and cherish our growing wood; the other, to renew the trees which have been and are continually cut down.

The quantity of acorns, that the oak bears, has made many people suppose, that nature has taken care for a renewal for us, and that, of this vast quantity of seeds which annually fall, there will be always an over-sufficient supply of young trees, which will grow up in the place of the old ones: but experience proves, that this is by no means the case. The greater number of these fallen acorns are devoured by a number of different animals, for whose nourishment nature has provided that abundance of them: and, of those which escape this fate, we are to consider how few can come to good, from the natural accidents they are unavoidably exposed to; they fall on a covered ground, where dead leaves, and decayed parts of branches of trees, usually prevent their touching the earth, into which they are to shoot; or, if they can shoot here, it is merely from the surface, where they are, in their slow growth, liable, while very tender, to all the inclemencies of frosts; add to this, that it is very difficult for such tender plants, as the young seedlings of these, to find room for growth or nourishment among the every-way-spreading roots of other trees; and the continual shade, and the want of free air, must render them very weakly and irregular in their growth, even supposing them to get over all the other difficulties.

It is very certain, that timber-trees of oak are frequently met with among the underwood of forests; but we shall always find this to be the case, not in the close places but on certain spots where there has been a vacancy or opening; and that, usually, where there are not, nor have at any time been, oaks in the neighbour-

hood of the ſpot. The acorns that fall from the oaks uſually come to nothing, from the beforementioned accidents; and theſe trees, which grow at diſtances, are owing to the acorns brought thither by birds, and accidentally dropped there. This is an inſtance familiarly verified by obſerving, that there are frequently little buſhes near woods, which, though of white-thorn, or other trees, are uſually ſurrounded and ornamented with young oaks; the jays and the like granivorous birds are the authors of this crop; for bringing the acorns from the adjoining woods, to eat under theſe buſhes, they drop many by the way, which they do not trouble themſelves to look for on the ground, and which, having here a freer ground to take root, and an open air to grow in, ſeldom fail of coming to good, unleſs deſtroyed while young.

In order to the preſerving our growing timber-trees, it would be a very uſeful law, that all, who cut down any number of oaks, ſhould alſo leave a given number in good condition for after-cutting; and that no timber ſhould be cut down, but at a proper age, in regard to the nature of the ſoil; ſince it is certain, that trees grow to their perfection at very different periods of time, in proportion to the depth of ſoil they have to grow in; and that, as it is, on the one hand, not for the intereſt of the ſtate to ſuffer trees to be cut, till at their perfection for ſize and ſoundneſs, ſo, after they are arrived at that perfection, it is equally certain, that they gradually decay.

The quality of the ſoil the tree ſtands in may be neceſſary to be obſerved to this purpoſe; but the quantity or depth of it is the great ſubject of inquiry; and a great number of obſervations have proved, that the proper ſeaſon for cutting oaks, in a ſoil of two feet and an half deep, is at fifty years old; thoſe, which ſtand in a ſoil of three feet and an half deep, ſhould not be cut down before ſeventy years; and thoſe which ſtand in a ſoil of four feet and an half deep, or more than that, will increaſe in goodneſs, and in ſize, till they are an hundred years old: and obſervation has proved, that, after theſe ſeveral periods, the trees begin to decay.

This ſeems the beſt rule to eſtabliſh, in regard to the common ſoils; but thoſe which grow in a lighter or more ſandy ſoil, may have their periods changed from theſe to forty, to ſixty, and to eighty years at the greateſt depth; and after theſe times it is always beſt to fell the wood meant for public ſervice, whether then wanted, or not, ſince it is much better to keep it in public magazines, than to leave it to be daily decaying.

Heaths, and other uncultivated places, where there is no regular growth of wood, but where fern and uſeleſs plants alone ſeem to flouriſh, uſually afford alſo ſome ſtraggling trees of the oak. Theſe, probably, have had their origin from acorns dropped by birds; but theſe ſeldom grow tall or regular, ſince, not having been defended from the injuries of cattle, they are uſually browſed on and ſtunted, while young, and ſo become crooked and ſhort-trunked, or pollard trees. Theſe, though not of ſuch value as the regular oaks, yet deſerve care, both with regard to their preſervation and felling, ſince they afford a number of trees naturally bent and formed for many parts of ſhip-building.

The little care uſually taken of theſe trees, though on this occaſion of great value, ſeems to threaten a general loſs of them; but, as trees, thus naturally crooked and bent, are of value, it is a laudable attempt to try at the finding a regular method of producing ſuch; and this is eaſily practicable, by following the ſame method by which theſe wild ones become ſo. They wholly owe their figure to the cattle's biting off their tops, while young, and afterwards biting off again the tops of the ſhoots from the firſt wound. In this manner, if a number of young trees, ſet apart for the experiment, have their tops cut off at two, four, ſix, eight, ten, and twelve feet from the ground, and, four years afterwards, the ſhoots from theſe ſtunted tops are again cut in the ſame manner, the trees will be found afterwards to grow up in all the irregularly crooked figures that can be conceived; and, by this means, a ſupply of naturally crooked wood may be raiſed for all the occaſions of ſhipbuilding, with infinitely greater eaſe, and more certainty, than by the method, propoſed by ſome, of bending them down with weights tied to their tops, while young.

As to the ſupply of young wood in the place of what is cut down, there are ſome circumſtances, which have not had the attention paid to them which they deſerve. The ſpring froſts, which come on at a time when the ſhoots, by which nature is to raiſe the ſupply for what is cut down, are juſt preparing to grow, are of prodigious injury, and do not leſs miſchief to theſe, than to the young ſhoots of garden-plants, though the diſtant hope of the ſucceſſion to the proprietor, and uſually alſo the diſtance of the place, and want of repeated obſervations, occaſions its not being perceived. This, however, may in a great meaſure be guarded againſt. Frequent experiments, and repeated obſervations, prove, that the miſchief done by theſe froſts affects, in a much greater degree, thoſe ſhoots which are expoſed to the north, than thoſe which face the ſouth; and that it is greatly more powerful againſt ſuch as are wholly expoſed to the wind than againſt ſuch as are ſheltered. Theſe known circumſtances may give the hint to a method of ſaving, at leaſt, a great part of a wood to be felled, from this deſtruction, to its renewal, by the making it a rule to begin cutting down on the ſouth ſide; and, as the whole felling is a work of ſome years, the ſtanding wood of every ſeaſon will defend the young ſhoots of the newly-cut ſtumps, the following ſpring, not only from the north expoſure, but will ſhelter them alſo from the wind.

Many prudent managers have made fine eſtates of their coppice-woods, by regularly felling a certain portion every year, and providing for a renewal of the firſt cutting againſt the felling of the laſt portion, by proportioning the time of growth to the quantity to be cut every year; and there is great intereſt to be made of a true knowledge of the growth of wood in this manner. Whoſoever obſerves the growth of young trees will find, that the ſecond year's growth is much more conſiderable than that of the firſt; the third year's growth is much more conſiderable than that of the ſecond, and ſo on for many years, the yearly growth of young wood greatly increaſing every ſeaſon, up to a certain time or age of the tree; after which, the increaſe in bulk, by growth, becomes gradually leſs. The great advantage to be made of coppice wood would be by knowing this intereſting period, and ſeizing on it, always to cut down the trees juſt at that time when they have arrived at the end of their quick growth, and ſo, ſetting nature to work with new ſhoots, to employ the ſame ſpeed on enriching again the owner. Regular obſervation and experiment alone can aſcertain this happy period; but any man, who has much coppice-wood upon his eſtate, may aſſure himſelf of it, by cutting a given quantity every year, for ten years ſucceſſively, and then carefully reviewing the differences of the yearly produce.

Preſerving of TIMBER.—When boards, &c. are dried, ſeaſoned, and fixed in their places, care is to be taken to defend and preſerve them; to which the ſmearing them with linſeed-oil, tar, or the like oleaginous matter, contributes much.

The Dutch preſerve their gates, port-cullices, draw-bridges, ſluices, &c. by coating them over with a mixture of pitch and tar, whereon they ſtrew ſmall pieces of cockle and other ſhells, beaten almoſt to powder, and mixed with ſea-ſand, which incruſts and arms it wonderfully againſt all aſſaults of wind and weather.

Timber, felled before the ſap is perfectly at reſt, is very ſubject to the worms; to prevent or cure which, Mr. Eveyln gives us the following ſecret, as moſt approved: put common ſulphur in a cucurbit, with as much aqua-fortis as will cover it three fingers deep; diſtil it to a dryneſs, which is performed by two or three rectifications.

Lay the ſulphur remaining at bottom on a marble, or in a glaſs, and, with the oil it diſſolves into, anoint the timber. This, he adds, not only infallibly prevents or cures the wormineſs, but preſerves all kinds of woods, and even many other things, as ropes, nets, and maſts, from putrefaction, either in air, water, ſnow, &c.

For

For ſuch as would go a ſhorter way to work, two or three anointings with linſeed oil may do very well. As to poſts, &c. that are to ſtand in the ground, the burning the outſides to a coal is a great preſervative.

As to the chops or cleſts green timber is liable to after working, a very great eye-ſore in many fine buildings, they are cloſed by anointing, ſupplying, and ſoaking it with the fat of powdered beef broth, twice or thrice repeated. Some carpenters uſe greaſe and ſawduſt mingled for the ſame purpoſe. But the former method is excellent, only it is not to be uſed, while the timber is green.

Seaſoning of TIMBER, a term uſed by our huſbandmen to expreſs the preparing timber after it is felled, for cutting and working up for uſe.

As ſoon as felled, it ſhould be laid in ſome dry airy place, but out of the reach of too much wind or ſun, which, when in exceſs, will ſubject it to crack and fly. It is not to be ſet upright but laid along, one tree upon another, only with ſome ſhort blocks between to give it the better airing, and prevent its becoming mouldy, which will rot the ſurface and produce muſhrooms on it. Some perſons daub the trees all over with cow-dung, which occaſions their drying equally, and prevents their cracking, as they are otherwiſe very apt to do.

Some recommend the burying timber in the earth, as the beſt of all ways of ſeaſoning it; and others have found it a fine preſervative to bury their timber under the wheat in their granaries; but this cannot be made a general practice. In Norway, they ſeaſon their deal planks, by laying them in ſalt water for three or four days, when new ſawed, and then drying them in the ſun; this is found a great advantage to them; but neither this, nor any thing elſe, can prevent their ſhrinking.

The ſeaſoning timber by fire is the beſt way of all, for piles, and other pieces that are to ſtand under the earth, or water. The Venetians firſt found out this method, and the way they do it is this: they put the piece to be ſeaſoned in a ſtrong and violent flame in this; they continually turn it round by means of an engine, and take it out when it is every-where covered with a black coaly cruſt; by this means the internal part of the wood is ſo hardened, that neither earth nor water can damage it for a long time afterwards. This method is practiſed in many places for ſeaſoning the poſts for paling of parks, &c. and has this to recommend it, that in the very oldeſt ruins we have ever been acquainted with, there have been found many times pieces of charcoal, all of which has been found uninjured, though buried in the earth for many ages. *Mortimer's Huſbandry.*

To meaſure round timber, let the mean circumference be found in feet and decimals of a foot; ſquare it, multiply this ſquare by the decimal 0.079577, and the product by the length. Ex. Let the mean circumference of a tree be 10.3 feet, and the length 24 feet. Then $10.3 \times 10.3 \times 0.079577 \times 24 = 202.615$, the number of cubical feet in the tree. The foundation of this rule is, that when the circumference of a circle is 1, the area is 0.0795774715, and that the areas of circles are as the ſquares of their circumferences.

But the common way uſed by artificers for meaſuring round timber, differs much from this rule. They call one fourth part of the circumference the girt, which is by them reckoned the ſide of a ſquare, whoſe area is equal to the area of the ſection of the tree; therefore they ſquare the girt, and then multiply by the length of the tree. According to their method, the tree of the laſt example would be computed at 159.13 cubical feet only.

For the method of meaſuring round timber by the ſliding rule, ſee RULE.

For meaſuring hewn or ſquare timber, the cuſtom is, to find the middle of the length of the tree, and there to meaſure its breadth, by clapping two rules to the ſides of the tree, and meaſuring the diſtance betwixt them; in like manner they meaſure the breadth the other way. If the two be found unequal they are added together, and half their ſum is taken for the true ſide of the ſquare.

As to the ſtrength of timber, Mr. Parent is the firſt who has treated this ſubject in a ſcientific manner, and, in order to enforce his demonſtrations, he made ſeveral experiments, with various ſcantlings of oak and fir. Mr. Muller, in his Treatiſe on Fortification, gives the following problem, to determine the ſtrength of a ſcantling, whoſe dimenſions are given. He ſuppoſes that all the fibres of the wood are ſtrait, and of the ſame ſtrength, even in its weakeſt part, and that the fibres are the ſame in the ſame ſort of wood; and although this may not be ſtrictly true, yet it is ſufficiently near enough in practice ſo as to cauſe no ſenſible error. Suppoſe the ſcantling A B C, plate CXXVII. *fig.* 12. to be ſupported in the middle D, by the edge of a triangular block R, and two equal bodies, P, Q, to be ſuſpended at A and C, equally diſtant from the middle B, of ſuch a weight as to break the ſcantling. It is evident, that the weights P and Q will cauſe the ſcantling to bend at firſt, ſo as to make a kind of curvilinear angle at B, and then to break in that place, in a ſection B D, perpendicular to either of the ſides A C; now as the power or force of theſe weights is more or leſs, according as they are ſuſpended farther from, or nearer to the fixed point D; theſe forces will therefore be in proportion to the products of the weights of each multiplied by its reſpective diſtance from the ſection B D; or becauſe the weights and diſtances are here ſuppoſed equal, twice the product of one of the weights P, multiplied by its diſtance from the ſection B D, will expreſs the force of theſe two weights. The force of the weights being thus determined, the reſiſtance or ſtrength of the wood is next to be found, which is done in the following manner. Let *a c b* (*fig.* 13.) repreſent the ſection of the ſcantling; it is evident that this area repreſents the ſum of all the fibres to be torn or broken; and as they are all ſuppoſed equal, and of the ſame ſtrength, this area will expreſs the ſum of the ſtrength of all the fibres: but as the point D, or the baſe *a b* of the ſection is fixed; and the directions of the fibres perpendicular to the area *a c b*: the force or reſiſtance of each fibre is equal to the product of its ſtrength, multiplied by its diſtance from the baſe *a b*; and therefore the ſum of all the fibres placed in the ſame line *d f*, parallel to the baſe *a b*, multiplied by their diſtance *a d*, from that baſe *a b*, will expreſs their momentum or reſiſtance. What has been proved in regard to all the fibres placed in the line *d f*, is equally true of all thoſe placed in any other line parallel to the baſe *a b*: and therefore the ſum of all theſe products will expreſs the total ſtrength or reſiſtance of the wood: but by the nature of the center of gravity, the product of the area *a c b*, multiplied by the diſtance of its center of gravity from the baſe *a b*, will expreſs the total ſtrength or reſiſtance of all the fibres, or that of the whole ſcantling; conſequently, having the ſtrength of any ſcantling of the ſame wood determined by experiment, that of any other may be found.

If the ſcantling A C (*fig.* 14.) be ſupported at both ends by the triangular blocks P Q, and the weight W, hanging in the middle B: then if we ſuppoſe the weight P and Q in the firſt figure, to repreſent the blocks P and Q in this; then as each block ſupports half the weight W; it is evident, that the weight W, multiplied by the diſtance A B or B C, will expreſs its momentum or force. Moreover, ſince the weight W is ſuſpended in the middle betwixt the fixed points, it is evident that each block ſupports exactly half the weight; and as the power or force of this weight on the blocks P, Q, is as the product of half the weight multiplied by the diſtance A B or B C of its direction from the fixed point, it follows, that the whole force of this weight is as twice the product of half the weight W, multiplied by A B or B C; or as the whole weight W multiplied by the diſtance A B or B C.

Hence alſo, if the length A C of the ſcantling between the fixed points A, C, be c, the area of the ſection s; the diſtance of its center of gravity from the baſe d, and the weight W, w; then will $\frac{1}{2} c w$ expreſs the force of the weight W, and $d s$ the ſtrength of the ſcantling: therefore the momentum of the weight is to the momentum of the ſcantling as $\frac{1}{2} c w$ is to $d s$; or, as w is to $\frac{2 d s}{c}$, and if this ratio be given $w = \frac{2 d s}{c}$.

From whence may be drawn ſeveral uſeful conſequences. 1. The ſtrengths of two ſcantlings of the ſame wood, and of different dimenſions; or, which is the ſame, the weights they will bear, are to each other as the products of their ſections multiplied by the diſtances of the centers of gravity from the baſe, divided by their lengths. 2. The ſtrengths of two ſcantlings of the ſame wood, which have the ſame length, are as the products of their ſections multiplied by the diſtances of their centers of gravity from the baſe. 3. The ſtrengths of two ſcantlings of the ſame wood, which have equal ſections, are as the diſtances of their centers of gravity divided by their lengths. 4. The ſtrength of ſcantlings of the ſame wood, whoſe diſtances of their centers of gravity of their ſections, from the baſe, are equal, will be to each other as their ſections divided by their lengths.

Again, if the ſection of the ſcantling A C be a rectangle placed flat on one of its ſides, which we call b, and its height or other ſide a; then will ab expreſs the area of the ſection; and the diſtance d of its center of gravity from the upper baſe, will be $\frac{1}{2}a$, therefore the equation already found $w = \frac{2ds}{c}$ becomes here $w = \frac{aab}{c}$, which ſhews that the ſtrength of a rectangular ſcantling laying flat on one of its ſides, is as the product of the ſquare of its height multiplied by its baſe, and divided by its length. Hence, a deal board of an inch thick, and ten inches broad, being placed on its flat ſide, and then on its narrow ſide; the force in the firſt caſe, will be to the force in the ſecond as 1 is to 10. For the force in the firſt caſe will be as 10 multiplied by the ſquare of unity; and in the ſecond, as unity multiplied by the ſquare of 10; that is, as 10 is to 100, or as unity is to 10. So that if it bears 50 pounds when it lies flat, it will bear 500 when it lies on the narrow ſide.

TIMBRE, or TIMMER, in heraldry, denotes the creſt of an armory, or whatever is placed at the top of the eſcutcheon, to diſtinguiſh the degree of nobility, either eccleſiaſtical or ſecular.

TIME, *Tempus*, a ſucceſſion of phænomena in the univerſe; or a mode of duration, marked by certain periods or meaſures, chiefly by the motion and revolution of the ſun.

The idea of time, in the general, Mr. Locke obſerves, we acquire by conſidering any part of infinite duration as ſet out by periodical meaſures: the idea of any particular time or length of duration, as a day, an hour, &c. we acquire, firſt by obſerving certain appearances at regular, and, ſeemingly, at equidiſtant periods.

Now by being able to repeat thoſe lengths or meaſures of time, as often as we will, we can imagine duration, where nothing really endures or exiſts; and thus we imagine to-morrow, next year, &c.

Some of the latter ſchool philoſophers define time to be the duration of a thing, whoſe exiſtence is neither without beginning nor end: by which, time is diſtinguiſhed from eternity.

Time is diſtinguiſhed into abſolute and relative. Abſolute time, is time conſidered in itſelf, and without any relation to bodies, or their motions. This flows equally, that is, never proceeds faſter or ſlower, but glides on in a conſtant, equable tenor, Relative time, is the ſenſible meaſure of any duration by means of motion. For ſince that equable flux of time does not affect our ſenſes, nor is any way immediately cognizable thereby, there is a neceſſity for calling in the help of ſome nearly equable motion to a ſenſible meaſure, whereby we may determine its quantity, by the correſpondency of the parts of this with thoſe of that.

Hence, as we judge thoſe times to be equal which paſs while a moving body, proceeding with an equable velocity, paſſes over equal ſpaces; ſo we judge thoſe times to be equal which flow while the ſun, moon, and other luminaries, perform their revolutions, which, to our ſenſes, are equal.

But ſince the flux of time cannot be accelerated nor retarded, whereas all bodies move ſometimes faſter and ſometimes ſlower, and there is, perhaps, no perfectly equable motion in all nature, it appears hence to follow, that abſolute time ſhould be ſomething truly and really diſtinct from motion. For let us ſuppoſe the heavens and ſtars to have remained without motion from the very creation, does it hence follow, that the courſe of time would have been at a ſtand? Or, rather, would not the duration of that quieſcent ſtate have been equal to the very time now elapſed?

Aſtronomical TIME, is that taken purely from the motion of the heavenly bodies without any other regard.

Civil TIME, is the former time accommodated to civil uſes, and formed and diſtinguiſhed into years, months, days, &c.

TIME, in muſic, is an affection of ſound, whereby we denominate it long or ſhort, with regard to its continuance in the ſame degree of time.

Common or duple time, is of two ſpecies. 1. When every bar or meaſure is equal to a ſemi-breve, or its value, in any combination of notes of a leſſer quantity. 2. When every bar is equal to a minim, or its value, in leſſer notes. The movements of this kind of meaſure are various, but there are three common diſtinctions; the firſt ſlow, the ſecond briſk, and the third very quick. See CHARACTER.

TIME, in fencing. There are three kinds of time; that of the ſword, that of the foot, and that of the whole body. All the times that are perceived out of their meaſure, are only to be conſidered as appeals, or feints, to deceive and amuſe the enemy. See FENCING.

TIN, *Stannum*, ♃, a well-known whitiſh metal, ſofter than ſilver, yet much harder than lead.

Tin is the lighteſt of all the metals: it is remarkable for a quality that no other of them has, which is, that when bent it makes a crackling noiſe. It is harder than lead, but leſs ſo than any other of the metals: it is malleable in a very remarkable degree, though leſs ſo than lead: it may be eaſily drawn into a coarſe wire, but if this be attempted to be brought to any degree of fineneſs, it ſnaps and breaks under the workman's hands.

Tin is leſs ſuſceptible of ruſt than moſt of the other metals: it is very little elaſtic, and ſcarce at all ſonorous. It melts with a much ſmaller degree of fire than any other metal, a heat but a little greater than boiling-water being ſufficient to fuſe it. It melts before it grows red-hot, like lead; and a degree of heat ſo much leſs even than that requiſite to the running of lead, is neceſſary to the fuſing of this metal, that it may be eaſily ſeparated from the other by eliquation; and if the fire be kept under a mixed maſs of the two, ſo low as to be juſt hot enough to melt the lead, the tin will all run off from it.

Tin amalgamates very readily with mercury, and may be mixed in fuſion with moſt other metals, and as readily ſeparated from them again by the beforementioned proceſs of eliquation. It is the leaſt ſimple of all the metals, being brought, by a very ſmall degree of fire, to emit ſulphureous fumes: theſe are plainly the abſolute ſulphur of the metal. They do great injury to the people employed to work upon it, rendering them pale, and often abſolutely deſtroy them.

The conſequence of the emitting theſe fumes ſo abundantly is, that tin, of all metals, loſes moſt of its weight, and calcines moſt eaſily in the fire. Expoſed to the focus of a great burning-glaſs, it immediately melts, and ſends off a large quantity of thick white fume; the remaining matter is then a fine cryſtalline or gloſſy matter, in form of needles; theſe, if held ever ſo long in the ſame heat, undergo no farther change, never running into a maſs of glaſs, as the remains of moſt of the metals do under the ſame circumſtances; but, like the glaſſes of the other metals, if expoſed again to the ſame heat, laid on a piece of charcoal, they immediately run into tin again; and the ſame thing happens if it be continued on the tile or coppel it was firſt placed on in the focus, and ſome fat matter, as tallow, or the like, be added to it.

Filings of tin thrown into the flame of a candle, take fire, and render the flame blue, emitting a viſible fume and a ſmell of garlic: melted in a crucible, with a mixture of nitre, it deflagrates. Its conſtituent matters, therefore, ſeem to be a cryſtalline earth which melts

with

with great difficulty, and an inflammable ſulphur; in which, from its ſmell, while calcining, and from its poiſonous quality, it is probable there may be ſomething of arſenic mixed.

Tin ſo far endures the force of lead and antimony in the refiner's teſt, that it is hardly to be ſeparated from them, unleſs by the addition of copper: it adheres to the reſt of the metals with greater eaſe than any other, and hence it is in continual uſe in covering plates of iron, and lining copper, and other metals, to prevent their ruſting, and to ſave the liquids put into them from taking up any bad qualities from thoſe metals, as it is much more difficultly diſſolved by common menſtruums, than either of them. Tin, in many things, greatly approaches to the nature of ſilver. It very readily melts with ſilver, gold, or copper; when the mixture is made with equal, or even a leſs quantity, it renders them extremely brittle; but it is very ſingular, that if it be mixed in a much larger quantity, they ſtill continue pliant and flexile. Ten parts of tin, and one of copper, make a maſs more rigid indeed than tin, yet malleable and ductile. Silver, of all metals, ſuffers moſt by an admixture of tin, a very ſmall quantity of it ſerving to make that metal as brittle as glaſs; and what is worſe, being very difficultly ſeparated from it again. The addition of about one tenth part of copper to tin makes it fit for the common uſes of life, in veſſels of various kinds, as it becomes, by the mixture, more durable; a little zink, added to this mixture, gives the metal a yellow colour; and, as it is mixed in greater or leſs quantity, makes it fit for caſting of cannon and for bells.

Iron readily mixes with tin, in fuſion, if the fire be briſk, and the iron be heated white hot before the tin be added. Twice the quantity of this metal, added to iron ſo heated, readily runs with it into an odd ſubſtance, which is very white and brittle, and readily anſwers to the magnet. This has been uſed, by ſome, as a pretence of its not being iron, and that the loadſtone would attract another metal beſide that; but the fallacy is eaſily diſcovered by any one that underſtands any thing of metallurgic analyſis.

Lead bears a conſiderable admixture of tin, without being affected as gold and ſilver are, which are both rendered brittle by it; at leaſt, its effects on this metal are in a much ſmaller degree. The very vapour of tin has the ſame effect with the metal itſelf on ſilver, gold, and copper, rendering them brittle. Many a metallurgiſt has been long plagued by theſe vapours by a piece of tin being accidentally among his charcoal; the conſequence of which has been, that, till it was burned wholly away, theſe metals have been rendered as brittle as glaſs under the hammer, by only being fuſed over theſe coals. It is owing to this property of tin, in making the metals it is mixed with brittle, that it renders them ſonorous. Mr. Boyle has expreſſed a wonder that tin, which is itſelf not much ſonorous, ſhould on mixture with copper render it more ſo; but if we conſider that the ſame ſort of diſpoſition of parts which renders metals rigid and brittle renders them ſonorous, the myſtery is explained.

The proper ſolvent of tin, in its true malleable ſtate, is aqua regia. It will not well diſſolve in any of the other menſtrua of the ſtronger kinds, nor indeed very readily in this. We are not, however, to wonder at this difficulty of ſolution in tin, ſince we find it contains much more ſulphur than any other metal, and ſulphur is not one of thoſe ſubſtances that are to be diſſolved by acids. That this is a fact, we find by putting calcined tin, inſtead of common malleable tin, into the menſtrum; for in this caſe even vinegar will diſſolve it. While tin is in its malleable ſtate, the weakeſt acids diſſolve it beſt. Verjuice, and it is ſaid even ſour apples boiled in tin veſſels, acquire a taſte of that metal, though the ſtrongeſt acids, aqua regia excepted, boiled in the ſame veſſels, acquire no flavour from it at all.

Many of the chemical writers have been of opinion, that, if the ſulphur could be thoroughly purged from tin, it would be no longer tin, but ſilver; it is certain that the two metals have many things in common. If diſſolved in aqua regia, tin is bitter, as well as ſilver, in ſolution with the nitrous acid; but the cryſtals which are produced from a ſolution of it in vinegar, after it has been calcined for forty-eight hours together, which is a neceſſary ſtep towards ſuch a ſolution, and which one would think ſhould bring it nearer to ſilver than before, if the diſſipating its ſulphur were the way to do it, differ wholly from thoſe of ſilver. We have indeed accounts, in many authors, of tin being made to yield a large quantity of ſilver by peculiar proceſſes; but that careful experimenter Mr. Boyle tells us, that all tin is not to be expected to yield thoſe advantages in the ſame manner; for that himſelf had ſeparated pure cryſtals of ſilver from one parcel of tin by a peculiar menſtruum, but that another parcel of the ſame metal would not anſwer in the ſame manner.

Though tin and lead readily unite in fuſion over a gentle fire, if the heat be afterwards raiſed to a violent degree, there is a viſible motion excited in the mixture; and the conſequence is, that both are reduced to a calx, and the lead becomes extremely difficult afterwards to vitrify.

The effect that zink has upon a mixture of tin and copper, the copper being in a larger proportion than has been uſually given in ſuch mixtures, is little known, and ſeems to be a ſecret that the people who are poſſeſſed of it intend to make uſe of to themſelves.

Tin, when it mixes itſelf with cryſtal in the earth, influences both its figure and colour. It gives it a pyramidal form conſiſting of four ſides, ſhort and with a broad baſe, and at the ſame time uſually communicates a yellow colour with an admixture of a duſky brown, which makes it much inferior to the yellow cryſtal made ſo by lead. Even the tin-grains, though very different ſubſtances from the cryſtals we are deſcribing, have ſomething of this yellow colour, which appears when they are broke into ſmall pieces, though in the maſs they are opake and blackiſh. In the making of the artificial gems, there is a method of obtaining this colour from tin, and communicating it to glaſſes. It ſeldom ſucceeds indeed in the common way of doing this by lead: but in vitrifications, where the baſis is borax, the calx of tin properly treated with vinegar yields cryſtals, which will communicate the true colour of the browner topazes to the vitrified maſs.

The ores of tin are very various, as it is found blended with all kinds of ſubſtances, with marcaſitic and ſtony matter, and even with other metals. The Germans have lately talked of finding native tin in the perpendicular fiſſures of ſome of their iron mines; but there ſeems no foundation for the opinion; for this pretended native tin wants the firſt of all the characters of a native metal, malleability. It flies to pieces under the hammer, and on trial in the fire proves to be a marcaſitic ore, very rich indeed in tin, a very ſingular and valuable ſubſtance, but not, as pretended, native tin. This remarkable ore is found in nodules from an ounce to three or four in weight; it is of a bright ſilvery colour, like the white arſenical pyritæ, but covered with a coarſe duſky cruſt: when properly worked, it is the richeſt tin-ore to be met with, five drachms of pure tin having been ſeparated from an ounce of it.

The next ore to this in richneſs, and that which has conſequently been uſually accounted the richeſt of all, is the tin-grain, or lapis jovius. This is an ore of tin, of a fine gloſſy black colour on the out-ſide, but, in thin pieces held up againſt the light, it is tranſparent and yellowiſh: it is the heavieſt of all the metalline ores, and is of a very irregular figure, but in the fineſt pieces it ſeems to approach to the ſhape of thoſe cryſtals which are found joined baſe to baſe, without any intermediate column. In ſize it is of the bigneſs of a large walnut down to that of a pin's head; for of that minuteneſs we meet with ſome perfect tin-grains.

After the tin-grain we ſhall mention a black and very heavy tin ore, of an irregular figure and metalline appearance; but this, though it promiſes very fairly by its weight, ſeldom yields ſo much as half a drachm of metal from the ounce, in its crude ſtate; if waſhed indeed, and all the foreign matter carried off, it may be reduced almoſt to the purity of the tin-grains before the working.

The tin-ores of Germany uſually contain a very large quantity of iron; ours are free from this admixture, and are greatly the more valued for it. Our other ores of

tin, beſides the two above deſcribed, are a browniſh or blackiſh ſtony one, very hard and heavy; this is debaſed by a great quantity of the ſtony matter, and requires careful waſhing before it is brought to the fire; and a yellowiſh or whitiſh ore, which are leſs heavy and more brittle than the others, and contain a large quantity of common ſulphur; and to theſe may be added another, in which the metal is yet more mixed with ſulphur: this is the mundic found in the tin-mines, which is very bright and ſhining, of a ſilver or gold colour, and often contains a large portion of tin, though it is not ſeparated from it without difficulty, becauſe of the abundance of ſulphur in the maſs. We have alſo red ore of tin, of a ſtony, and ſometimes of an earthy nature, and carrying ſo little of the appearance of an ore of this metal, that it is hard to gueſs what could lead any body to work it in expectation of it. It is however very rich.

Tin ore is alſo ſometimes found mixed with that of lead, and carrying the external appearance of lead only. Some of theſe ores are neglected in France, where they might turn to a very conſiderable account under proper management. The German ores of tin are uſually ſo much like iron, that, at firſt ſight, it is ſcarce poſſible to diſtinguiſh them. We are alſo finally to add to the number of tin ores the dodecahedral garnets ſold by our druggiſts; theſe are in general irregularly figured, but the moſt regular of them always conſiſts of twelve ſides; they are of a deep red colour, and in ſize from the bigneſs of the largeſt pea to that of a pin's head. Theſe are truly ores of tin, of the nature of the tin-grains, but not ſo rich.

There is ſomething very ſingular in the great gravity of tin-ore beyond that of the ores of other metals; but it contains ſo much arſenic, and is ſo dangerous to the perſon who works it, that experiments are not expected to be made very frequently on it.

The tin ores in general are ſtubborn and refractory in the fire; it is eaſy, however, to find whether an ore does contain this metal or not; for, if a piece of it be powdered and waſhed, and afterwards ſprinkled thinly over an iron-plate made white hot on the fire, the tin ore, in this caſe, if there be any in the maſs, will be found in little parcels of a red colour covered with grey flowers of an arſenical ſmell. The various kinds of mundic common in the Corniſh mines are not only rejected from the works as ores themſelves, but they are carefully ſeparated from among the other ores of a better kind, as they are apt to be very troubleſome, even in the ſmalleſt quantities, in working the reſt. They then pound and waſh the ore; and when they have thus ſeparated all the lighter impurities, till there is no longer any ſmell of ſulphur or of garlic, they grind it to a tolerable fine powder, and, after waſhing it again, it is carried to the melting-houſes, where it is melted into metal by mixing it with charcoal, and urging the fire to the utmoſt violence by the blaſt of large bellows. There is a cavity at the bottom of the furnace into which the metal runs, as it ſeparates from the ore, and out of which they let it by an aperture cloſed and opened at pleaſure, running it in cakes or pigs, which are the large blocks we ſee it in.

Tin ore, in general, contains a great quantity of arſenic, which diſcovers itſelf in the roaſting in form of a white cloud, and which it is very material to burn quite away, as it otherwiſe renders the metal brittle. Charcoal alone commonly ſerves for fluxing the ore of tin, but, if any be found refractory, a little common black pitch is an excellent addition.

The virtues of tin, as a medicine, given internally, have been celebrated by many of the ancient writers, but it has leſs credit at preſent. We have been told that in diſeaſes of the lungs, and in diſorders of the head and uterus, there is ſcarce any thing equal to it; and that in convulſions, epilepſies, and the madneſs ariſing from the bite of a mad-dog, it was a certain remedy. Theſe laſt are the only caſes in which it has any degree of credit at preſent, and that is rather among the vulgar than among phyſicians.

In the manufactures it is of great uſe in ſolders, and when amalgamated with mercury, and a little biſmuth added to make it run thin, it ſerves in the ſilvering of looking-glaſſes. By calcination it makes a ſoft powder called putty, of great uſe in poliſhing glaſs and gems, and alſo in making enamels.

The preparations of tin are, 1. Powdered tin, made by pouring melted tin into a wooden box, the inſide of which is chalked all over, and briſkly ſhaking it till cold, when a part of it will be found reduced to powder, which is ſaid to be good for worms, but we have no certain accounts of its good effects. 2. Salt of tin, obtained by pouring diſtilled vinegar upon calcined tin, heating the ſolution till it near boils, and afterwards evaporating it to a pellicle, and ſetting it in a cool place; then there will ſhoot very pellucid and hard cryſtals, which are recommended in hyſteric caſes, to be given from two to four or five grains at a doſe. 3. The antihectic of Poterius. 4. The aurum muſivum, or, as it is commonly called, moſaicum, moſaic gold.

To theſe preparations uſed in medicine, we may add one well known as a coſmetic: it is a magiſtery of tin prepared in the manner of that of biſmuth, by firſt mixing ſix ounces of ſpirit of nitre with one ounce of ſpirit of ſea-ſalt, and then putting tin into this liquor, or aqua regia, till it is capable of holding no more; laſtly, pour the ſolution into ſix or eight quarts of ſpring water, and the tin will be precipitated in form of a white powder, which ſhould be waſhed ſeveral times, and then dried for the uſe of the ladies in pomatums, to render the ſkin white and ſoft.

TIN-FLOORS, a contrivance uſed by our huſbandmen who propagate hops to dry them after the gathering. The common way of doing this is either on a hair-cloth on a malt-kiln, or elſe by the ooſt. See the articles HOPS and OOST.

In both theſe ways, however, the hops ſuffer very much; the beſt way is by the tin-floor. It is thus done: let a ſquare brick room be built, with a door on one ſide, and a long fire-place of a foot wide in the middle, reaching almoſt acroſs it; let holes be made at the ſides of this fire-place, to let out the heat into the room; and, at the height of five feet above this, let a floor be made of laths of an inch thick, laid lattice-wiſe. Let this be covered with great plates of double tin, taking care that the joinings of the tin be well ſoldered, and lie upon the laths, not over the interſtices, which may be about four inches wide. Let a row of boards be fitted round the edge of this floor, to keep the hops from falling off; then lay on a covering of hops of a foot thick; then make a ſmall fire of charcoal in the mouth of the fire-place, and the hops will dry very quick and very regularly. They may be continually ſtirred about while drying, and, when enough, a part of the boarded edge of the kiln may be taken down, and the dried parcel thruſt out, and a freſh parcel laid on in their place. A very ſmall quantity of fuel is ſufficient in this way, and any fuel will do, for the ſmoke never comes at the hops.

There is a very great improvement ſtill upon this method of drying hops, uſed by ſome people; this is the making a wooden cover, of the ſize of the tin-floor; this is covered with plates of tin nailed on, and is ſuſpended over the kiln in ſuch a manner, that it may be let down at pleaſure, when the lower parts of the hops are dry. This is to be let down within ten inches of their ſurface, and there acts as a reverberatory, and drives back the heat on the upper ones: thus all the trouble of turning is ſaved, and the hops are much better dried than in any other way. *Mortimer's Huſbandry.*

TIN-HATCH, in mining, a term uſed by the people of Cornwall, to expreſs the opening into a tin-mine. They alſo call it a tin-ſhaft.

They make ſeveral openings in the ſides of the hills where they ſuſpect veins of ore to be. All theſe, except that which opens on the head of the mine, are called eſſay-hatches; but that which does ſo, is made their entrance afterwards, and changes its name to that of the tin-hatch.

TIN PLATES, an article of manufacture very common among us, and vulgarly called tin. It is iron plated over with tin. The French call it *fer blanc*, white iron; as we do ſometimes in England. It was

once known under the diſtinct name of latten. See the article LATTEN.

TINCTURE, *Tinctura*, in pharmacy and chemiſtry, a ſeparation of the finer and more volatile parts of a mixed body, made by means of a proper menſtruum diſſolving and retaining the ſame.

The management and rules of procedure in tinctures, elixirs, medicated wines, vinegars, decoctions, and infuſions, depend upon the ſame reaſon and principles; theſe ſeveral forms differing only in the fitneſs of the materials for ſuſpenſion, in fluids of different conſiſtences, and the beſt manner thence ariſing for drawing them out: the principal rule in all which is, that the liquor, made uſe of for a menſtruum, or vehicle, be more or leſs ſpirituous, as the ingredients, which are ordered in it, are of a lighter or more fixed nature; and the times of ſtanding in digeſtion, either hot or cold, are alſo to be proportioned accordingly.

A general rule for the properly making light tinctures may be taken from the following bitter: take half an ounce of Seville orange-peel ſhaved thin, half a dram of gentian root thin ſliced, a ſcruple of the tops of Roman wormwood, half a dram of cardamom ſeeds, and the ſame quantity of cochineal, each of them lightly bruiſed; put theſe ingredients into a pint of French brandy, let them ſteep for one night, and filter the liquor the next morning, and thus you have a fine light bitter.

Theſe bitters are of the number of many other ſubſtances, where the goodneſs of a tincture does not more depend upon the choice of the ingredients, than upon the manner of their being infuſed; for, if ſuch be ſuffered to remain too long in the menſtruum, or, if heat be uſed in extracting the tincture, the groſs terreſtrial and nauſeous parts of the ingredients will be fetched out, and the tincture will thus be loaded with a heavy indolent matter of little virtue. *Shaw's Lectures.*

A great variety of tinctures may be given to common water, and many remarkable things occur in their changes on the addition of common menſtruums: take a large ſpoonful of the ſyrup of pomegranate-flowers, mix it with five ſpoonfuls of water; the mixture will be of a very lively and brilliant red: for a violet colour, take the ſame quantity of ſyrup of violets, and the ſame of water. When the tinctures are thus prepared, have at hand a phial in which is a ſmall portion of oil of tartar, which will only look like water remaining after the waſhing of the phial.

Pour the red or the violet tincture into this phial, and it immediately becomes a fine graſs-green. Diſſolve the quantity of a walnut of crude ſal armoniac in a glaſs of water, pour all out except three or four drops at the bottom, and pour into this glaſs the fine red liquor, and it immediately becomes black as ink. In order to change the purple liquor red, only have a ſmall quantity of ſpirit of vitriol in the bottom of a phial, and pour it into this; the violet water, immediately on this, becomes of a florid red.

Steep Braſil wood in common water, or in white wine twenty hours; the liquor will then look of the colour of red wine; pour this into a glaſs waſhed with vinegar, and it becomes of a fine yellow like ſack. If this experiment be made with white wine, the wood and the vinegar make ſo little alteration in it, that it may be drank afterwards, and the whole proceſs ſeems a way of turning red port into ſack. Into this liquor when yellow, drop a few drops of a tincture of benjamin made in ſpirit of wine, and it immediately loſes its yellow colour and becomes white. Beat ſome galls to fine powder, and rub the powder on a towel; then put into a baſon of water, in which any perſon is going to waſh their hands and face, a ſmall piece of common green vitriol, or copperas; after the perſon has waſhed, let them have this towel to wipe on, and the hands and face will be as black as if waſhed with common writing-ink; the copperas in the water and the galls on the towel making real ink where they mix. This does no laſting injury to the ſkin, but will come off again upon waſhing with ſoap. *Philoſ. Tranſ.* N°. 238.

TINCTURE *of Antimony*, Tinctura Antimonii, is thus made. Take ſalt of tartar a pound, antimony half a pound, rectified ſpirit of wine a quart; reduce the antimony to a powder, and mix it with the ſalt by fuſion over a ſtrong fire. When it is cold, powder it, and pour on the ſpirit of wine; digeſt them together three or four days in a ſand heat, and then filter off the clear tincture for uſe. The ſalt of tartar yields a tincture as well as the antimony.

TINCTURA *Fœtida*, the ſtinking tincture, a form of medicine in the late London Diſpenſatory prepared in this manner: take aſſa-fœtida four ounces, rectified ſpirit of wine a quart, digeſt them together for ſome time, and then ſtrain off and filter the tincture through paper.

TINCTURA *Sacra*, a tincture of aloes, called alſo hiera picra. The late London Diſpenſatory has ordered this to be made of only eight ounces of aloes, and two ounces of winter's bark powdered, and put into five quarts of white-wine, which is to be ſhook often, and kept in fuſion a week or more without heat, and then ſtrained off for uſe.

TINCTURA *Saturnina*, the lead tincture, a name given in the late London Diſpenſatory to the tincture before called tinctura antiphthiſica.

It is made of ſugar of lead and green vitriol, each two ounces; of rectified ſpirit a quart. The ſalts are ſeparately to be reduced to powder, and then put into the ſpirit; then the whole is to ſtand ſome days without heat to extract the tincture, and afterwards filtered through paper.

TINCTURA *Senæ*, a form of medicine preſcribed in the new London Pharmacopœia, and intended to ſtand in the place of the medicine commonly called elixir ſalutis, and Daffy's elixir. It is thus made: take ſtoned raiſins ſixteen ounces, leaves of ſena a pound, carraway ſeeds an ounce and half, cardamom-ſeeds half an ounce, proof ſpirit a gallon; digeſt all together without heat, and, when the tincture is well extracted, preſs off the ſpirit, and filter it for uſe.

TINCTURA *Styptica*, a form of medicine made with very little trouble and apparatus, and ſerving to ſupply the place of that elaborate preparation the tincture of Helvetius; it is preſcribed in the late London Pharmacopœia, and is to be made by mixing a drachm of calcined green vitriol with a quart of French brandy, tinctured by the caſk; this is to be ſhook together that the brandy may turn black, and then ſtrained off for uſe. *Pemb. Lond. Diſpen.*

TINCTURE is alſo applied by the heralds, to the colour uſed in eſcutcheons, or coats of arms; under which may be likewiſe reduced the two metals, or and argent, becauſe often repreſented by yellow and white.

TINEA, in medicine, a diſeaſe, the ſame with the achor or cruſta lactea. See ACHOR.

TIN-GLASS, a name given by ſome to a mineral water more commonly called biſmuth. See BISMUTH.

TINGING *of Marble*. The art of doing this has, in ſeveral perſons hands, been a very lucrative ſecret, tho' there is ſcarce any thing in it that has not at one time or other been publiſhed. Kircher has the honour of being one of the firſt, who publiſhed any thing practicable about it. This author meeting with ſtones in ſome cabinets ſuppoſed to be natural, but having figures too nice and particular, to be ſuppoſed of nature's making, and theſe not only on the ſurface, but ſunk through the whole body of the ſtones, was at the pains of finding out the artiſt who did the buſineſs; and on his refuſing to part with the ſecret on any terms, this author, with Albert Gunter, a Saxon, endeavoured to find it out; in which they ſucceeded at length very well. The method is this: Take aqua fortis and aqua regia of each two ounces, ſal armoniac one ounce, ſpirit of wine two drams, about twenty-ſix grains of gold, and two drams of pure ſilver; let the ſilver be calcined and put into a vial, and pour upon it the aqua fortis; let this ſtand ſome time, then evaporate it, and the remainder will firſt appear of a blue and afterwards of a black colour. Then put the gold into another vial, pour the aqua regia upon it, and when it is diſſolved, evaporate it as the former. Then put the ſpirit of wine upon the ſal armoniac, and let it be evaporated in the ſame manner. All the remainders, and many others made in the ſame manner from other metals, diſſolved in their proper acid menſtrua, are to be kept ſeparate, and

uſed

uſed with a pencil on the marble. Theſe will penetrate without the leaſt aſſiſtance of heat, and the figure being traced with a pencil on the marble, the ſeveral parts are to be touched over with the proper colours, and this renewed daily till the colours have penetrated to the deſired depth into the ſtone. After this, the maſs may be cut into thin plates, and every one of them will have the figure exactly repreſented on both ſurfaces, the colours never ſpreading. The niceſt method of applying theſe, or the other tinging ſubſtances, to marble, that is to be wrought into any ornamental works, and where the back is not expoſed to view, is to apply the colours behind, and renew them ſo often till the figure is ſufficiently ſeen through the ſurface on the front, though it does not quite extend to it. This is the method that, of all others, brings the ſtone to a nearer reſemblance of natural veins of this kind.

TINNING, the covering or lining any thing with melted tin, or with tin reduced to a very fine leaf. Looking-glaſſes are foliated, or tinned with thin plates of beaten tin, the whole bigneſs of the glaſs, applied or faſtened thereto by means of quickſilver.

TINNITUS AURIUM, a noiſe or buzzing in the ear, when it receives ſounds which do not exiſt, or at leaſt which are not produced by the motion of the external air; and the ear being filled with a certain ſpecies or ſound, cannot admit other ſounds, unleſs they are very violent. The tinnitus is of two kinds, the one proceeding from a diſtemperature of the organ of hearing, the other from a diſorder of the brain.

The cure, according to Heiſter, is to be performed by temperate diaphoretic powders, and reſolving eſſences, commonly called anticatarrhales; as of amber, the woods, roſemary, together with diaphoretics and alexipharmics, taken often in a day, with tea of betony, with roſemary-flowers, ſage, or lavender, or ſaſſafras. In the morning, and at noon, the eſſences are to be taken, and at night the powders. Eſſence of amber may be applied outwardly, either alone or with a few drops of oil of amber, or one or two drops of oil of camomile put into the ear with cotton, morning and evening; or a grain or two of amber and muſk, or caſtor, in cotton, either alone or with Peruvian balſam; or carminative oils, ſuch as aniſe, fennel, carraways, or camomile; not neglecting pediluvia, and frequent rubbing of the feet and head. Many have alſo been cured by the vapour of a decoction of lavender-flowers, or roſemary, made with wine, being conveyed to the ear with a funnel. If the diſeaſe is obſtinate and inveterate, the patient muſt bleed in the foot, together with ſcarifications, and frequent purges, for the ſake of revulſion. Etmuller ſays, this noiſe proceeding from burning fevers, will go away of itſelf; but if it proceeds from chronic diſorders, it is difficult of cure. However, he recommends vapours of ſouthern-wood, wormwood, origanum, eye-bright, balm, &c. as alſo of amber, or gum ammoniac; likewiſe oil of peach kernels, and ſpirit of wine, put into the ear with cotton.

The following formula is greatly praiſed. White hellebore and caſtor, take of each two drams; of coſtmary, one dram and a half; of rue, two drams; euphorbium, half a dram; of bitter almonds, two drams and a half: let them be boiled in the oil of rue, and poured warm into the ear. Shaw recommends half an ounce of oil of bitter almonds, with two drams of oil of caſtor, externally applied.

TIPSTAFF, an officer who attends the judges with a kind of ſtaff tipt with ſilver, and takes into his charge all priſoners who are committed or turned over at a judge's chambers.

TIRE, or TEER *of Guns*, in the ſea-language, is a row of cannon placed along a ſhip's ſide, either above, upon deck, or below, diſtinguiſhed by the epithets of upper and lower tires.

TITANS, in the heathen mythology, the offspring of Titan, the elder brother of Saturn, upon whom, and his ſon Jupiter, they made war, in order to recover the ſovereignty of which Titan had been deprived. The poets repreſent them as a race of giants, ſprung from the earth, and invading heaven; and tell us, that Jupiter overcame them with thunder, and drove them down to the very bottom of hell.

TITHES, *Decimæ*, in law, denote the tenth part of the increaſe that annually ariſes from the profits of lands, and the induſtry of the pariſhioners, which is payable for the maintenance of the parſon of the pariſh.

Tithes, it is obſerved, are of three kinds, predial, perſonal, and mixed. Predial tithes are ſuch as immediately ariſe from the land, whether it be by manuring, or its own nature; as corn, grain, hay, wood, fruit, and herbs, which are ſaid to be due without the deducting the coſts. Perſonal tithes are thoſe which only ariſe from a perſon's labour and induſtry, they being a tenth part of his gains in trade, &c. after charges deducted; but this is ſeldom paid in England, and when it is, it is always due by cuſtom, and payable where the party dwells, hears divine ſervice, &c. Mixed tithes are ſuch as ariſe not directly from the ground, but from cattle and other things that receive their nouriſhment from, and are maintained thereout; as calves, colts, pigs, wool, lambs, milk, &c. Tithes are further divided into great and ſmall; great, are corn, hay, and wood; ſmall comprehend all other predial tithes beſides corn, &c. as likewiſe ſuch tithes as are perſonal and mixed: the great tithes generally belong to the rector, and the ſmall to the vicar.

It has been held, that where land is barren, and not manurable without extraordinary charge, ſuch land being converted into tillage, ſhall, for the firſt ſeven years after the improvement, be free from paying tithes; but during that ſpace of time it ſhall pay ſuch ſmall tithes, as have been uſually paid before, and afterwards the full tithe, according as it is improved: nevertheleſs, if land is ſuffered to be over-run with buſhes, or become unprofitable through want of huſbandry, in that caſe it cannot properly be called barren; and if the ſame be grubbed up, or ploughed and ſowed, it immediately pays tithes.

As to corn it is tithed by the tenth cock, or ſheaf, which if the owner does not ſet out, he is liable to an action upon the ſtatute; likewiſe where a pariſhioner will not ſow the land, the parſon may bring his action againſt him. On the other hand, when the tithes are ſet forth, if the parſon do not carry them away in a reaſonable time, but lets the ſame be too long on the ground, to the prejudice thereof, he may be alſo ſubject to an action.

The treble damages, granted by ſtatute, are recoverable in the temporal courts by action of debt, thoſe damages not being limited where to be recovered; and it is the opinion of ſome, that the double value, or damages, above-mentioned may be recovered in the ſpiritual court, for this reaſon, that the perſon grieved may ſue in the eccleſiaſtical-court for the tithes themſelves, or a recompence in lieu of the ſame, and may alſo at the ſame time have the double value. Small tithes that are under the value of forty ſhillings, a parſon may recover before two juſtices of peace, who are no way intereſted in the tithes, within twenty days after demand, and two years after due: and the juſtices may, by diſtreſs, levy the money by them adjudged, upon the party's refuſal to pay it, ten days after notice, &c. The juſtices may likewiſe award coſts not above ten ſhillings, but with liberty to appeal to the quarter-ſeſſions, whoſe judgment ſhall be final, unleſs the title to ſuch tithes ſhall come in queſtion, &c.

Where a quaker refuſes either to pay or compound for great or ſmall tithes, the two next juſtices of the peace may, on complaint thereof made, ſummon ſuch quaker before them, and after examining the matter of complaint on oath, may, by order under their hands and ſeals, direct the payment in all caſes under ten pounds. And if, after ſuch order made, the quaker refuſes to comply therewith, any one of the juſtices may by warrant order the ſame to be levied by diſtreſs, &c. See 7 and 8 Wil. III. c. 34. which, by 1 Geo. I. c. 6. is made perpetual.

Notwithſtanding theſe acts, tithes, if of any conſiderable value, are generally ſued for in the exchequer by Engliſh bill, except where the ſuit is founded on the

ſtatute of 2 and 3 Ed. VI. for double or treble value, &c.

The cuſtom of giving or paying tithe is very ancient: in Gen. xiv. 20. Abraham gives Abimelech the tenth of all the ſpoils he had taken from the four kings he had defeated: in Gen. xxviii. 22. Jacob makes a vow, at Bethel, to give the tenth of all the riches he ſhall gather, in that ſojourn, to God.

But theſe tithes were free and voluntary; and, beſides, differed in divers other reſpects from what was afterwards called tithe: what Melchiſedec received, was only the tenth of the ſpoils, not of Abraham's poſſeſſions; and this once, not annually; and beſides, not as maintenance, which Melchiſedec wanted not, but as homage: add, that this was only from one prieſt to another; for Abraham had not only a prieſt in his loins, but was a prieſt himſelf. — And as to Jacob, who was alſo a prieſt, what he did was the effect of a vow, voluntarily taken, to offer the tenth of all he ſhould poſſeſs; not to any other prieſt, but to God himſelf upon an altar.

Under the new law, it is not Jeſus Chriſt that eſtabliſhed tithes, as it was God himſelf did it under the old law by the miniſtry of Moſes; the Chriſtian prieſts, and the miniſters of the altar of the new covenant, lived, at firſt, wholly on the alms and oblations of the devout.

In after times the laity gave a certain portion of their revenues to the clergy, but voluntarily, and not out of any conſtraint or obligation: the firſt inſtances we have of it, are in the IVth and Vth centuries.

This gift was called tithe; not that it was really a tenth part of their income, or near ſo much: but only in imitation of the tithes of the old law.

In the following age, the prelates in their councils, in concert with the princes, made an expreſs law to the purpoſe; and obliged the laity to give a full tenth part of their revenues, their fruits, &c. to the eccleſiaſtics.

This the church enjoyed without diſturbance for two or three centuries; but in the VIIIth century the laity got hold of part of theſe tithes, either by their own authority, or by grants and donations of the princes; and appropriated them to their own uſes.

Some time afterwards they reſtored them, or applied them to the founding of monaſteries or chapters; and the church conſented, at leaſt tacitly, to this reſtitution.

In 1179, the third council of Lateran, held under Alexander III. commanded the laymen to reſtore all the tithes they yet held to the church.

In 1215, the fourth council of Lateran, held under Innocent III. moderated the matter a little; and, without ſaying any thing of the tithes which the laity already poſſeſſed, forbad them to appropriate or take any more for the future.

Fra. Paolo, in his treatiſe of Beneficiary Matters, is of opinion, that the cuſtom of paying tithes under the new law began in France; and affirms, that there are no inſtances of it before the VIIIth and IXth centuries: but he muſt be miſtaken; for in the ſecond council of Matiſcona, held in 585, it is ſaid expreſsly, that the Chriſtians had a long time kept inviolate that law of God, whereby tithe of all their fruits was enjoined to be given to holy places, &c.

In effect, Origen, Hom. XI. on Numbers, thinks, that the old laws of Moſes, touching the firſt fruits and tithes both of cattle and of the fruits of the earth, are not abrogated by the goſpel; but ought to be obſerved on their ancient footing. The Vth canon of the council of Matiſcona orders tithe to be paid to the miniſters of the church according to the law of God, and the immemorial cuſtom of the Chriſtians, and that upon penalty of excommunication: which is the firſt penalty we find impoſed on ſuch as would not pay tithe. — On which grounds it is that many among the modern clergy hold their tithes to be jure divino.

Others, on the contrary, plead, that the recompence to be given church miniſters, is differently ordained by God, according to the differences he has put between his two great diſpenſations, the law and the goſpel: under the law he gave them tithes; under the goſpel, having left all things in his church to charity and Chriſtian freedom, he has given them only what ſhall be given them freely, and in charity. That the law of tithes is in force under the goſpel, all the proteſtant divines, except ſome among the Engliſh, deny; for though hire to the labourer be of moral and perpetual right, yet that ſpecial kind of hire, the tenth, can be of no right or neceſſity, but to the ſpecial labour for which God ordained it: that ſpecial labour was the levitical and ceremonial ſervice of the tabernacle, Numb. xviii. 21, 31. which was aboliſhed: the right therefore of the ſpecial hire muſt be aboliſhed too.

That tithes were ceremonial, is evident from their not being given to the Levites till they had been firſt offered as a heave-offering to the Lord, ver. 24, 28.

He, then, who by the law brings tithes into the goſpel, brings in likewiſe a ſacrifice, and an altar; without which, tithes, by the law, were unſanctified and polluted, ver. 32. and therefore were never thought of in the firſt Chriſtian times, till ceremonial altars and oblations had been brought back.

The Jews themſelves, ever ſince their temple was deſtroyed, tho' they have rabbies and teachers of the law, yet pay no tithes, as having no proper Levites to whom, nor altar whereupon, to hallow them; which argues, that the Jews themſelves never looked on tithes as moral, but merely ceremonial. Add, that tithes were not allowed to the prieſts and Levites merely for their labour in the tabernacle, but in conſideration of this likewiſe, that they were not allowed to have any other part or inheritance in the land, ver. 20, 24. and who, by that means, for a tenth, loſt a twelfth.

In effect, for the firſt three hundred years after Chriſt, no mention is made in all eccleſiaſtical hiſtory of any ſuch thing as tithes; though, in that time, altars and oblations had been recalled, and the church had miſerably judaiſed in many other things. The churchmen confeſſedly lived all that time on free-will-offerings; nor could the defect of paying tithe be owing to this, that there were wanting civil magiſtrates to enjoin it; ſince Chriſtians, having lands, might have given out of them what they pleaſed: and the firſt Chriſtian emperors, who did all things by advice of the biſhops, ſupplied what was wanting to the clergy, not out of tithes, which were never propoſed, but out of their own imperial revenues. The firſt authority produced, ſetting aſide the apoſtolical conſtitutions, which few of the patrons of tithes will inſiſt on, is a provincial ſynod at Cullen in 356, where tithes are voted to be God's rent; but, before that time, divers other abuſes and complaints had got ground, as altars, candles at noon, &c. And one complaint begot another; as it is certain that tithes ſuppoſe altars.

It is alleged, that tithes are of early and ſolemn force among us, having been paid by ſtatute ever ſince the Saxon king Athelſtan, anno 928: to which it may be anſwered, that Rome ſcot, or Peter-pence, had been likewiſe paid to the pope by ſtatute above 200 years longer, viz. from the year 725. And it is alſo to be obſerved, that theſe ancient tithes, among our anceſtors, kept a nearer analogy to their original in the Moſaic law; for the prieſts had but a third part, the other two thirds being appointed for the poor, and to adorn and repair the churches, as appears from the canons of Ecbert and Elfric.

TITLE, *Titulus*, an appellation of dignity, or quality, given to princes, and other perſons of diſtinction. Thus, the title of his Britannic majeſty, is king of Great Britain, France, and Ireland; that of the French king, is king of France and Navarre: and ſo of others. The pope aſſumes the title of holineſs, and the cardinals that of eminence, &c.

TITLE, in law, denotes any right which a perſon has to the poſſeſſion of a thing; or an authentic inſtrument, whereby he can prove his right.

As to the titles of the clergy, they denote certain places wherein they may exerciſe their functions. There are ſeveral reaſons why a church is called Titulus; but that which ſeems to be the beſt, is becauſe anciently the name of the ſaint to whom the church was dedicated, was engraved on the porch, as a ſign that the ſaint had a title to that church; and from thence the church itſelf was

afterwards called Titulus. In this ſenſe a title ſignifies the church to which a clergyman was admitted, and where he is conſtantly to reſide: and by the canons none ſhall be ordained without a title. This is in order to keep out ſuch from the miniſtry who, for want of maintenance, might bring a diſgrace upon the church: can. 31. In ſhort, according to ſome writers, ſuch a title is an aſſurance of being preferred to an eccleſiaſtical benefice; that is to ſay, a certificate that the clerk is provided of ſome church or place, or where the biſhop that ordains him, intends ſhortly to admit him to a benefice or curacy then void.

TITMOUSE, *Parus*, in ornithology, a genus of birds, the beak of which is of a ſubulated form, and the point of the tongue truncated.

Of this genus there are many elegant ſpecies, among which the creſted and blue titmouſe are not the leaſt beautiful.

TITUBATION, or TREPIDATION, a kind of libration, or ſhaking, which the antient aſtronomers attributed to the cryſtalline heavens, in order to account for certain irregularities which they obſerved in the motions of the planets.

TITULAR denotes a perſon inveſted with a title, in virtue of which he holds an office or benefice, whether he perform the functions thereof or not.

The appellation of titular is frequently alſo given to a perſon who has the title and right of an office or benefice, but without having poſſeſſion, or diſcharging the functions thereof.

TMESIS, *τμησις*, in grammar, a figure whereby a compound word is ſeparated into two parts, and one or more words placed between them: thus, for *quæcunque*, Virgil ſays, *quæ me cunque vocant terræ*, &c.

TOAD, *Rubeta*, in zoology, belongs to the ſame genus with the common frog. See FROG.

The toad is larger than the frog, with a thick body, a broad back, and the belly ſwelled and inflated: its ſkin is conſiderably thick, and full of tubercles, of a duſky and blackiſh colour on the back, and ſpotted on the belly: it is naturally a loathſome and diſagreeable object.

TOBACCO, *Nicotiana*, in botany, a genus of plants, whoſe flower is monopetalous and funnel-ſhaped; the tube is longer than the cup; and the limb, which ſpreads open, is divided into five acute-pointed ſegments; the ſtamina conſiſts of five ſubulated filaments, topped with oblong antheræ; the fruit is an oval capſule, with a furrow on both ſides, opening at the top in two cells, which contain a great many rough kidney-ſhaped ſeeds.

There are ſeveral ſpecies of tobacco; the flowers of ſome are leſs acute-pointed than others; they are all natives of America, and brought originally from thence, and at firſt were in great eſteem for their medicinal qualities.

This plant was not known in Europe, till after the diſcovery of America by the Spaniards: The Americans on the continent call it petum, and thoſe of the iſlands yoli.

It was firſt brought into Europe by M. Nicot, from the iſland Tobago, in America, about the year 1560, whence its Engliſh name; and is now cultivated for medicinal uſe in our gardens. It is perennial, as is ſaid, in America; and annual with us.

Tobacco is cultivated in ſeveral parts of America, particularly in the Caribbee Iſlands, Virginia, &c. where they are forced to mix aſhes with the ſoil, to prevent its riſing too thick. After ſowing, they water it every day; and on very hot days cover it up, to prevent its being ſcorched by the ſun.

When the plants are grown to a convenient pitch, they are tranſplanted into a ſoil well prepared for their reception: care is alſo taken to keep this ground clear of weeds, and to pull off the loweſt leaves of the plant, that ten or fifteen of the fineſt leaves may have all the nouriſhment. When theſe leaves are ripe, which is known by their breaking when bent, the ſtalks are cut, and left to dry two or three hours in the ſun; after which they are tied together two and two, and hung on ropes under a ſhed to be dried by the air. And when the leaves are ſufficiently dried, they are pulled from off the ſtalks, and made up in little bundles; which being ſteeped in ſea-water, or, for want thereof, in common water, are twiſted in manner of ropes, and the twiſts formed into rolls, by winding them with a kind of mill around a ſtick: in which condition it is imported into Europe, where it is cut by the tobacconiſts for ſmoaking, formed into ſnuff, and the like.

Beſides the tobacco of the Weſt-Indies, there are conſiderable quantities cultivated in the Levant, the coaſts of Greece and the Archipelago, the iſland of Malta and Italy.

The marks of good twiſt-tobacco, are a fine ſhining cut, an agreeable ſmell, and that it have been well kept. Tobacco is either taken by way of ſnuff, as a ſternutatory, or as a maſticatory, by chewing it in the mouth, or by ſmoaking it in a pipe. It is ſometimes alſo taken in little longiſh pellets put up the noſe, where it is found to produce very good effects, to attract a deal of water or pituita, unload the head, reſolve catarrhs, and make a free reſpiration; for the ſubtile parts of the tobacco in inſpiration, are carried into the trachea and lungs, where they looſen the peccant humours adhering thereto, and promote expectoration. Some have left this tobacco in their noſes all night; but this is found to occaſion vomiting the next morning. Another thing charged on this way of application, is, that it weakens the ſight. When taken in great quantities in the way of ſnuff, it is found to prejudice the ſmelling, greatly diminiſhes the appetite, and in time gives riſe to a phthiſis. That taken in the way of ſmoak, dries and damages the brain. Borrhi, in a letter to Bartholine, mentions a perſon who, through exceſs of ſmoaking, had dried his brain to that degree, that after his death there was nothing found in his ſkull but a little black lump, conſiſting of mere membranes.

Some people uſe the infuſion of tobacco as an emetic; but it is a very dangerous and unjuſtifiable practice, and often produces violent vomitings, ſickneſs and ſtupidity.

Bates and Fuller give ſome receipts, in which tobacco is an ingredient, with mighty encomiums in aſthmatic caſes. A ſtrong decoction of tobacco, with proper carminatives and cathartics, given clyſter-wiſe, ſometimes proves of good effect in what is uſually called the ſtonecholic, and alſo in the iliac paſſion. A drop or two of the chemical oil of tobacco, being put on the tongue of a cat, produces violent convulſions, and death itſelf in the ſpace of a minute; yet the ſame oil uſed in lint, and applied to the teeth, has been of ſervice in the tooth-ach: though it muſt be to thoſe that have been uſed to the taking of tobacco, otherwiſe great ſickneſs, reachings, vomitings, &c. happen; and even in no caſe is the internal uſe of it warranted by ordinary practice.

A ſtrong decoction of the ſtalks, with ſharp-pointed dock and alum, is ſaid to be of good ſervice, uſed externally, in cutaneous diſtempers, eſpecially the itch: ſome boil them for that purpoſe in urine. The ſame is ſaid to be infallible in curing the mange in dogs.

Beat into a maſh with vinegar, or brandy, it has been found ſerviceable for removing hard tumours of the hypochondria.

In the iſland of Ceylon, there are alſo two kinds of tobacco cultivated for profit. They call both kinds dunkol, which ſignifies a leaf, the uſe of which is to be ſmoaked. The one ſort they call hingele dunkol, or ſingle dunkol; and the other dunkol kappada. The kappada tobacco is much ſtronger and more intoxicating than the other; but both kinds are the produce of the ſame plant, only the ſingle tobacco has very little care taken of it, being, after the ſowing, in a manner left to itſelf, while the other has great pains beſtowed upon it during the whole time of its growth, and till it is fit for uſe, in the following manner: they clear a little piece of ground, in which they ſow the ſeed of the tobacco, and againſt the time that the young plants have got three leaves a piece, they chuſe out another piece of ground into which to tranſplant them: this they hedge round, and turn their horned cattle into it, that their dung may fall upon

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Fig. 1.
Fig. 2.

Fig. 2.
Fig. 1.
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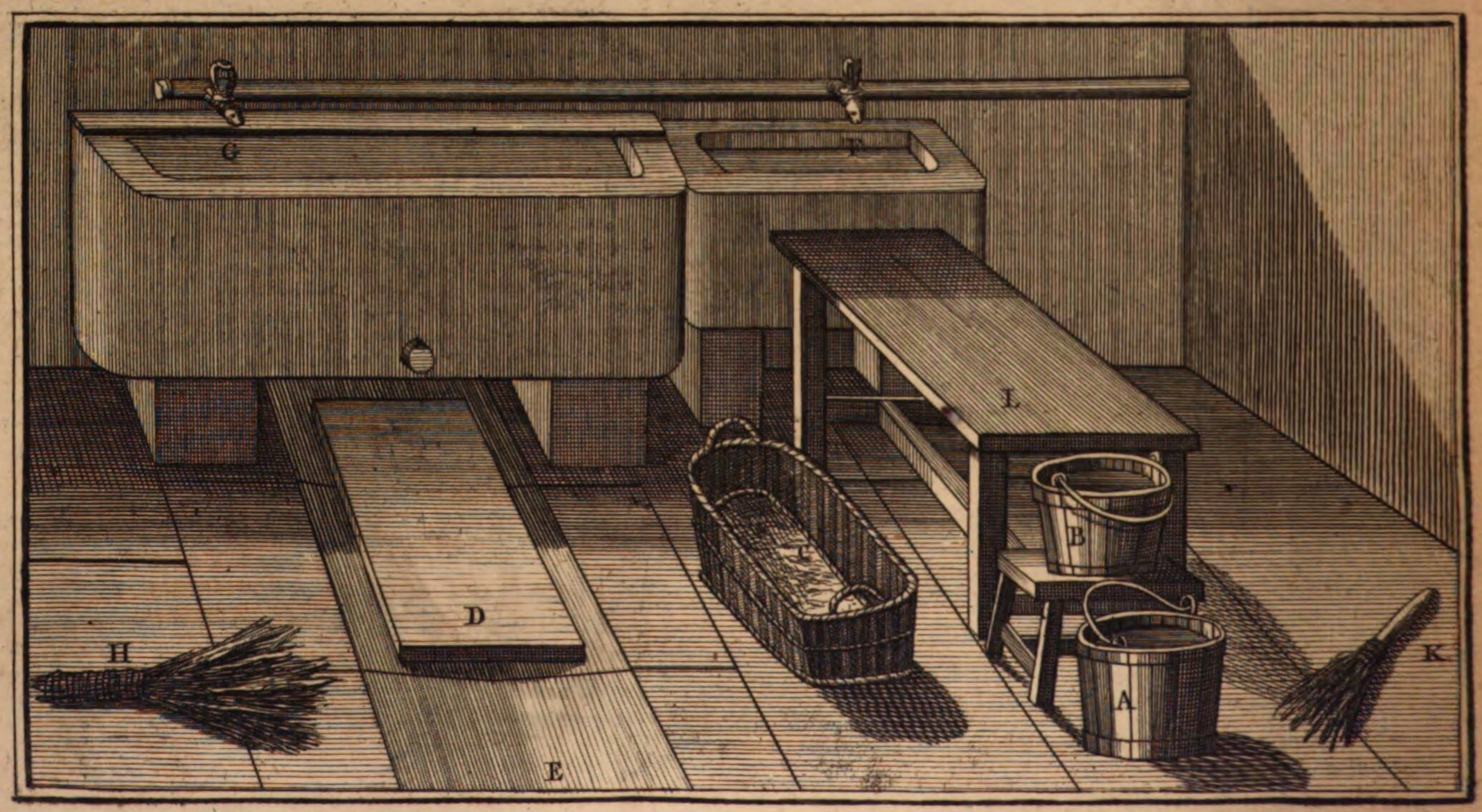
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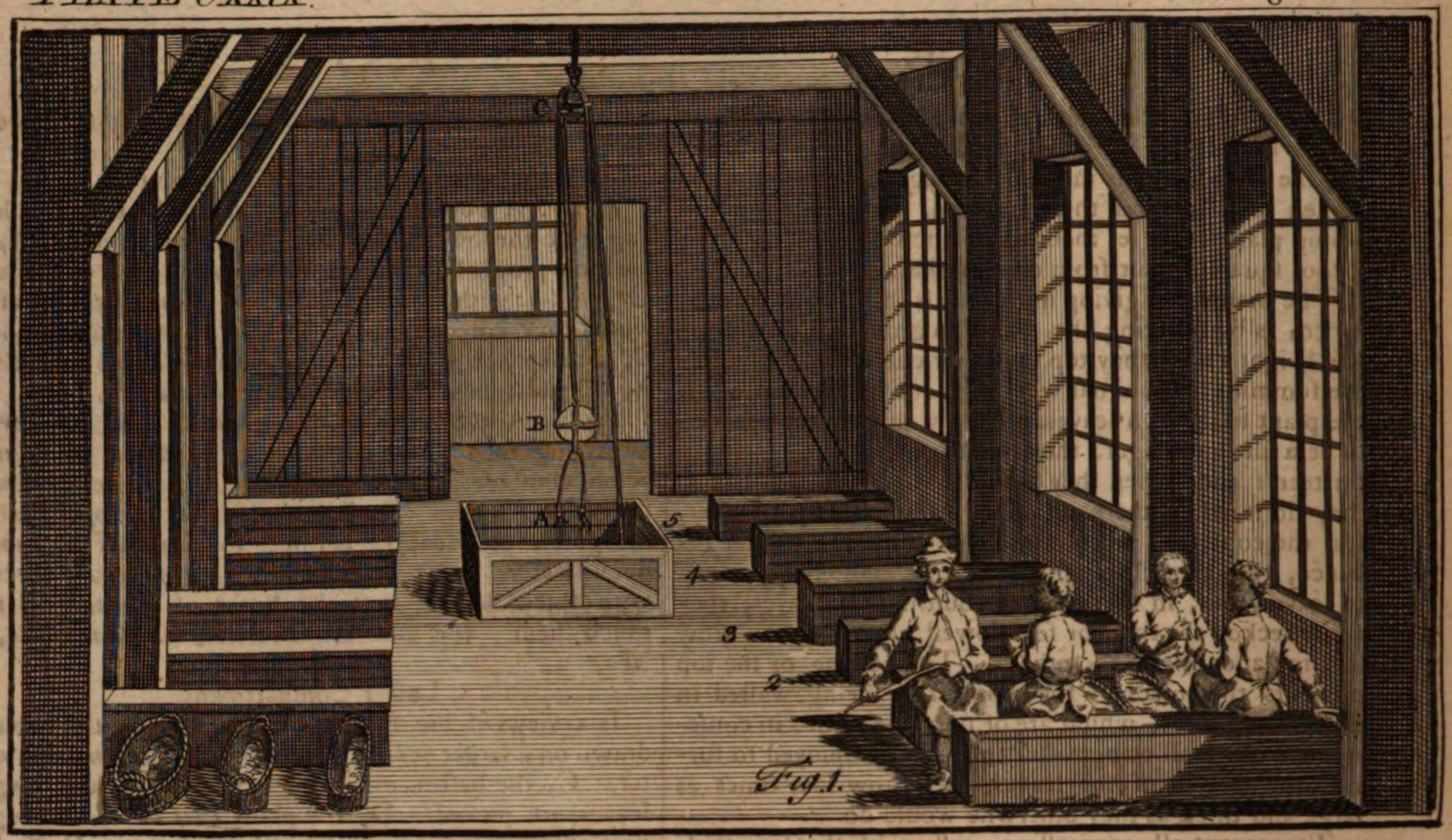


Fig. 1.

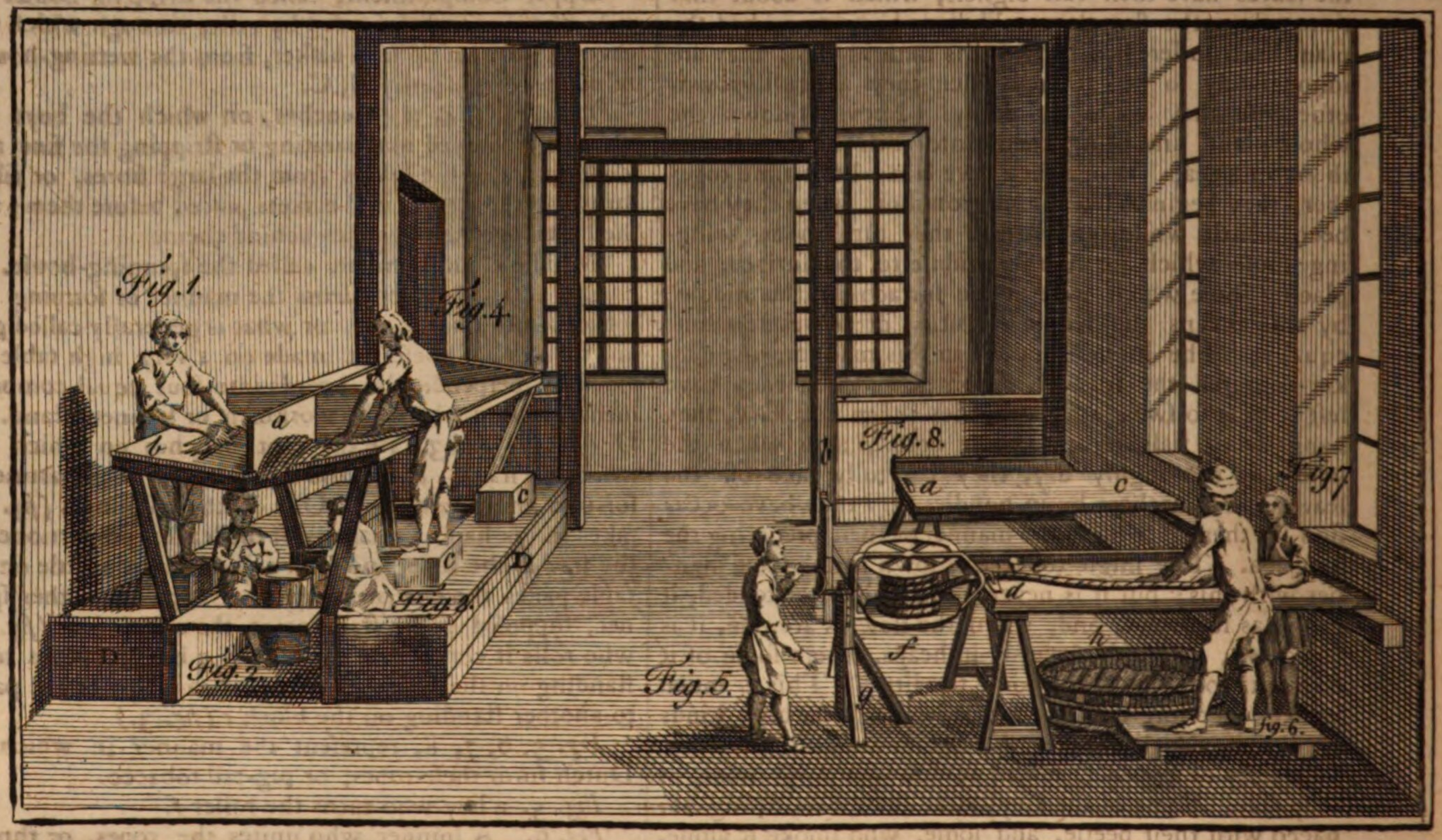


Fig. 10.

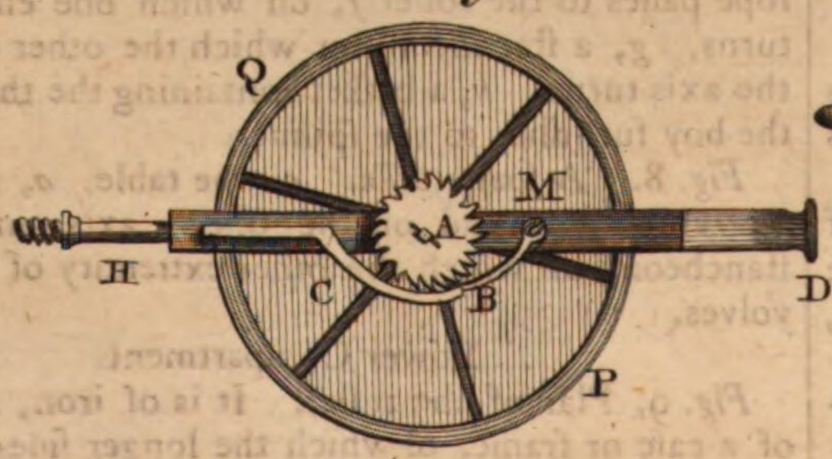
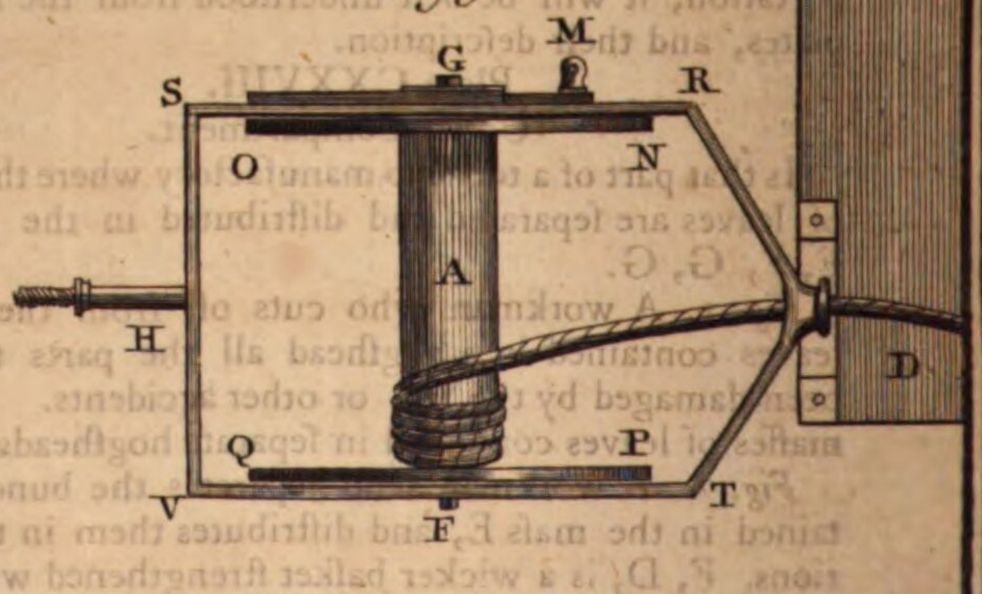


Fig. 9.



on it and ſufficiently enrich it. The ground is then dug with a ſharp hoe, or ſpade, in the form of a pick-ax, and the dung, by this means, thoroughly worked into it. When the earth is thus prepared, they take up the young plants, and ſet them in this new ground, at about a foot ſquare diſtant from one another.

The manner of giving more or leſs ſtrength to this tobacco, is by ſuffering the plants to grow to a greater or leſs height before they top them, or cut off the ſtalk at the ſummit. The uſual way is to cut off the top when the plant has fifteen leaves. If they intend the tobacco to be a little ſtronger, they do this when it has only thirteen; and, when they would have it ſtrongeſt of all, they do it when there are only eleven or twelve leaves. On the contrary, when they would have a milder tobacco, they cut it not off till there be eighteen or twenty leaves, but, in this way of counting the leaves, they never reckon the three or four loweſt, which do not grow ſo large and fine as the others. The cutting of the top prevents the juices of the plant from being waſted in flowers and ſeeds, which are of no value; and, in conſequence of it, all being, after this time, employed to furniſh the growth of the leaves, they grow four times as large and thick as they otherwiſe would do.

To prevent all unneceſſary waſting of the ſap, theſe plants are tended every day; and, as the young ſprouts appear in the joining of the leaves and ſtalks, they are continually cut off: this is done once in three days, till the leaves have their full bigneſs, which is about that time when the flowers would have been ripe, had the plant been ſuffered to grow in its natural way: they are immediately to be gathered when they are full grown, otherwiſe they waſte and decay. They cut down the whole plant, and bring them into their houſes, laying them on a heap. When they have lain a little time together, they begin to ſweat and grow hot: when they have been a little while fermenting, they turn them, bringing thoſe which are in the middle to the ſurface, and placing thoſe which were at the ſurface in the middle; by this means the whole quantity of leaves ferments equally. The longer they lie in this manner, the darker-coloured the tobacco becomes. When they have left it thus to ſweat as long as they judge neceſſary, they hang every ſtalk ſeparately on cords; and, when the whole is thoroughly dry, they carefully take off the leaves, and lay them by in bundles, till they have occaſion for them. This is the manner of their preparing the kappada. The ſingle tobacco is ſown in the ſame manner with this; but it is never tranſplanted nor tended, it grows as it pleaſes, and, when the flowers are ripe, it is cut down, and laid careleſsly in heaps, where ſome of it ferments too much, and ſome too little. This is much weaker therefore than the kappada; and, as both kinds are common in the place, the natives ſmoak them either ſeparately or together, mixed in different proportions, as they like. Some of the Ceyloneſe chew this ſtrong tobacco with their beetle, and ſome, who ſmoke it alone, uſe no pipe, but, taking a long leaf of it, they roll it up into a long form, and cover it with a leaf of the wattukan-tree; they then light one end of it, and ſmoak by the other, till the whole is conſumed. *Philoſ. Tranſ.* N°. 278.

With regard to the manufacturing of tobacco after importation, it will be beſt underſtood from the following plates, and their deſcription.

Plate CXXVIII.

Upper Compartment.

Is that part of a tobacco manufactory where the bundles of leaves are ſeparated and diſtributed in the partitions F, F, G, G.

Fig. 1. A workman who cuts off from the maſs of leaves contained in a hogſhead all the parts that have been damaged by the ſea, or other accidents. A, B, C, maſſes of leaves contained in ſeparate hogſheads.

Fig. 2. A workman who ſeparates the bundles contained in the maſs E, and diſtributes them in the partitions. F, D, is a wicker baſket ſtrengthened with ropes, and raiſed by the help of a pully, by which the picked leaves are hoiſted up into a loft above this part of the manufactory. H, H, H, H, rolls of tobacco placed above the partitions.

Middle Compartment, called the wetting houſe.

Fig. 1. A workman ſtanding behind the table L, chuſing from the bundles of leaves the longeſt and largeſt, as the moſt proper for covering the rolls of tobacco. Theſe he ſprinkles with water by means of a ſmall beſom; after which they are carried to the loft of the manufactory. C, a baſket, in which the picked leaves are ſprinkled. A, B, pails, in which the water is contained.

Fig. 2. A workman ſtanding on a heap of leaves, ſprinkling each layer with water, by means of a ſmall beſom compoſed of little twigs. F, G, are ſtone ciſterns for holding water. D, a plank laid over the open part of the gutter or canal E, deſtined to carry off the ſuperfluous water. The walls of this apartment are covered with thick boards, that the heaps of leaves may not touch them. It is alſo furniſhed with different tables, as M.

Lower Compartment.

Is a view of the ſame apartment or wetting-houſe, drawn on a larger ſcale. A, B, pails for holding the water. C, the baſket into which the longeſt and largeſt leaves are picked. D, the plank that covers the open part of the gutter E. F, G, ſtone ciſterns. H, K, beſoms for ſprinkling the layers of leaves, as they are laid in heaps.

Plate CXXIX.

Upper Compartment, called the ſtripping-houſe.

A, the aperture defended by rails, through which the leaves are drawn up in a baſket, from the wetting-houſe, by means of the pully B, C.

Fig. 1, 2, 3, 4, 5. Benches, on which the boys ſit, who are employed in ſeparating or ſtripping the fine and tender parts of the leaves from the large fibres, or ribs; throwing the former into baſkets placed before them; and the latter over the benches behind them.

Middle Compartment, called the ſpinning-houſe.

Fig. 1, 2, 3, 4, repreſents the manner of forming the tobacco into ſmall ropes, or what is generally called pig-tail tobacco. Theſe are made on a very high table divided by perpendicular boards into four equal compartments, before which the workmen or ſpinners ſtand. D, D (*fig.* 2, and 3) are the foot benches on which the workmen ſtand. *Fig.* 1 and 4, are empty compartments for two other ſpinners. One of theſe ſpinners (*fig.* 2.) takes in his hand a quantity of the leaves, proportioned to the ſize of the rope, and after rolling them a little on the table paſſes the end of the twiſted rope to another ſpinner, ſuppoſed to be ſtanding at the empty part (*fig.* 1.) who rolls it cloſer, and paſſes it to a boy ſuppoſed to be ſtanding on the block *c* (*fig.* 4.). From this boy it paſſes to another ſtanding on the block *c* (*fig.* 3.)

Fig. 5, 6, 7, 8, repreſent the manner in which the Dutch form theſe ropes, or pig-tail tobacco.

Fig. 5. a boy who turns the roller *f*.

Fig. 6. A ſpinner who unites the ropes, or threads ſpun by the other workman (*fig.* 1, 2, 3, 4.) and forms them into a new and larger rope.

Fig. 7. A boy who furniſhes the threads to the ſpinner. *e*, is a diſh containing a ſpunge filled with olive oil, which the ſpinner often rubs upon his hands, that the rope may paſs with more facility between them and the table. Thoſe who ſpin the firſt threads have alſo ſponges filled with oil. *d*, a gugeon of wood, over which the rope paſſes to the roller *f*, on which one end of its axis turns. *g*, a ſtancheon on which the other extremity of the axis turns. *h*, a baſket containing the threads which the boy furniſhes to the ſpinner.

Fig. 8. A ſpare table. *a e* the table. *a*, the gugeon, on which one end of the roller's axis turns. *b*, the ſtancheon, on which the other extremity of the axis revolves.

Lower Compartment.

Fig. 9. Plan of the roller. It is of iron, and conſiſts of a caſe or frame, of which the longer ſides R S, T V, are perforated at G and F, with two round holes, for receiving the pivots of the arbor A, on which it revolves. The longer ſides are connected together by means

means of the traverſe piece S V, and the parts R D, T D, which join at the ſocket D, through the aperture of which the thread paſſes. The extremities of the arbor A, are terminated by two circles N O, P Q, the elevation of which is ſeen in the profil (*fig.* 10.) and fixed on their inner ſide by two iron plates. In the middle of the traverſe piece S V, is fixed a large iron pin H, which forms the pivot of the arbor. At the extremity of that pivot is a ſcrew, which receives the aperture K, of the winch K L. The handle L, is moveable at the pivot which connects it to the winch. The pivot H, revolves on the gugeon on the top of the ſtancheon *g*, and the ſocket D, in that fixed on the table at *d* (*fig.* 5.)

Fig. 10. Is a profil of the roller. Q, the elevation of one of the circles fixed to the extremity of the arbor. A, a denticulated wheel fixed on the ſquare extremity of the pivot G (*fig.* 9.). B, a catch, which is continually puſhed againſt the teeth of the denticulated wheel, by means of the ſpring C. M, a pin with an eye, which by means of a ſcrew faſtens the end of the catch B, to the ſide of the frame, and which is taken out when the arbor is charged with a ſufficient quantity of the ſpun rope.

Plate CXXX.

Upper Compartment, called the rolling-houſe.

Fig. 1. A workman, who unwinds the rope from the roller *f*, moving on the two gugeons *d*, *e*, and paſſes it to the roller.

Fig. 2. The roller. This workman has before him an inſtrument (repreſented at large, *fig.* 6. in the lower compartment) called a matrix, furniſhed with two pins of wood, round which he winds the rope (as repreſented at *fig.* 5. in the lower compartment). After taking three turns about the pins he faſtens them together, as repreſented in the figure, and takes coil from the matrix. This coil forms the center and mould of the roll. Having thus formed the mould, he coils or rolls the rope round it in the manner repreſented in *fig.* 2. where *a* is the rope coming from the roller, *b* the roll, *c* a wooden mallet with which he often ſtrikes the rope, in order to make it lie cloſe in the roll.

Fig. 3. is another table for the ſame purpoſe.

Fig. 4. is a perſpective view of the preſs for preſſing the rolls. It is compoſed of two thick planks of elm. The upper is pierced with two holes, through which the wooden ſcrews A C, B D, paſs. The under plank is alſo pierced, but the holes are female ſcrews. On the under plank the rolls of tobacco, as D, E, F, are placed and preſſed, by turning the ſcrews, with the lever G.

Middle Compartment, called the cutting-houſe.

Fig. 1. The cutter ſtanding at a table, and having before him a roll of tobacco, *a d*, mounted on a machine repreſented in the lower compartment of the plate. And taking the end of the rope in his hand, he applies it to the matrix or meaſure lying before him, and with a knife cuts it into lengths, and lays them together as at *e*. In this manner he continues his work till the whole roll is cut into proper lengths. *b*, *c*, is an upright piece, pierced with a long mortiſe thro' which the extremity of the arm *a b*, which carries the ſuperior pivot, paſſes, and is fixed at a height proportioned to that of the roll. *f*, a ſupport for the candle, *g*, a baſket, in which the lengths are carried to be depoſited, according to their lengths and qualities, in proper caſes.

Fig. 2. repreſents the caſes, in which the above lengths are depoſited.

Lower Compartment.

Fig. 3. The cutting table, in another point of view, drawn on a larger ſcale. A B C D, the machine on which the roll is mounted. D C, its foot. B C, its vertical poſt, pierced with a long mortiſe. The ſides of this poſt are alſo pierced with ſeveral round holes, for receiving an iron pin, which fixes the arm at any determined height. A B, the arm whoſe tenon paſſes thro' the above mortiſe. A, the ſuperior pivot, which enters the center of the roll. F, a round copper plate, which is fixed upon the foot of the machine by four wooden ſcrews. The pivot turns in the center of that plate. The upper part of the pivot is ſquare, and received in a hole G, of which the plan is repreſented at H. E, the board on which the cutter cuts his lengths.

Fig. 4. The cutting knife.

Fig. 5. The matrix charged with a ſkain.

Fig. 6. The matrix ſeparately.

Fig. 7. The mallet uſed by the workman, who forms the rolls.

Fig. 8. The matrix with which the cutter meaſures his lengths. *r s*, a view of the upper ſide of the matrix. *t u*, a view of the lower ſide.

Fig. 9. A ſingle length of the rope, equal to the length of the matrix.

TOD *of Wool*, a quantity containing twenty-eight pounds, or two ſtone.

TOES, called by anatomiſts *digiti pedis*, are the extreme diviſions of the feet, anſwering to the fingers of the hands.

The bones of the toes of both feet are twenty-ſix in number, ſometimes twenty-eight; being much ſlenderer, except that of the great toe, than thoſe of the fingers: they have alſo a much leſs free motion than thoſe of the fingers: the great toe has only two bones, and the reſt three; except the little toe in very old people, in whom the two extreme phalanges of the little toe grow together, ſo as to form only one bone; whence we find, in this caſe, fewer bones in each foot than thirteen.

Adheſions of the TOES.—It is a frequent thing to meet with new born infants with their fingers or toes cohering or grown together, either by a ſtrict adheſion of fleſh, or elſe by ſome looſe productions of the ſkin, as in the feet of ducks and geeſe; and a diſorder of the ſame kind is alſo ſometimes found in adults, from accidents; as when the fingers and toes have been neglected, after an excoriation of them by burns or wounds. In both theſe caſes the ſurgeon's aſſiſtance is neceſſary, partly to remove the deformity, and partly to reſtore the proper uſe of the fingers.

Theſe adheſions, according to the nature of the diſorder, are to be ſeparated two ways, either by cutting out the intermediate ſkin with a pair of ſciſſars, or elſe barely by dividing them from each other with the ſame inſtruments. When this is done, to prevent their coheſions again, each finger muſt be inveſted ſeparately with a ſpiral bandage about an inch broad, dipped in lime-water and ſpirit of wine.

Sometimes the fingers, inſtead of adhering to each other, grow to the palm of the hand, from wounds or burns, ſo that they cannot be by any means extended, or drawn back to open the hand. The method of relieving this diſorder is firſt very carefully to ſeparate the fingers from their adheſions to the palm, without injuring their tendons; then dreſs them with a vulnerary balſam, and ſcraped lint, and extend them on a ferula or thick paſteboard; and let them remain in this extended poſture, ſeparately to be dreſſed till they are perfectly healed; but at every dreſſing they muſt be gently moved, to prevent a rigidity or ſtiffneſs of the joints. *Heiſter's Surgery.*

TOGA, in Roman antiquity, a wide woollen gown or mantle; which ſeems to have been of a ſemi-circular form, without ſleeves; differing both in richneſs and largeneſs, according to the circumſtances of the wearer, and uſed only upon occaſion of appearing in public.

Every body knows that the toga was the diſtinguiſhing mark of a Roman: hence, the jus togæ, or privilege of the toga, was the ſame with the privilege of a Roman citizen; that is, the right of wearing a Roman habit, and of taking, as they explain it, fire and water through the Roman empire.

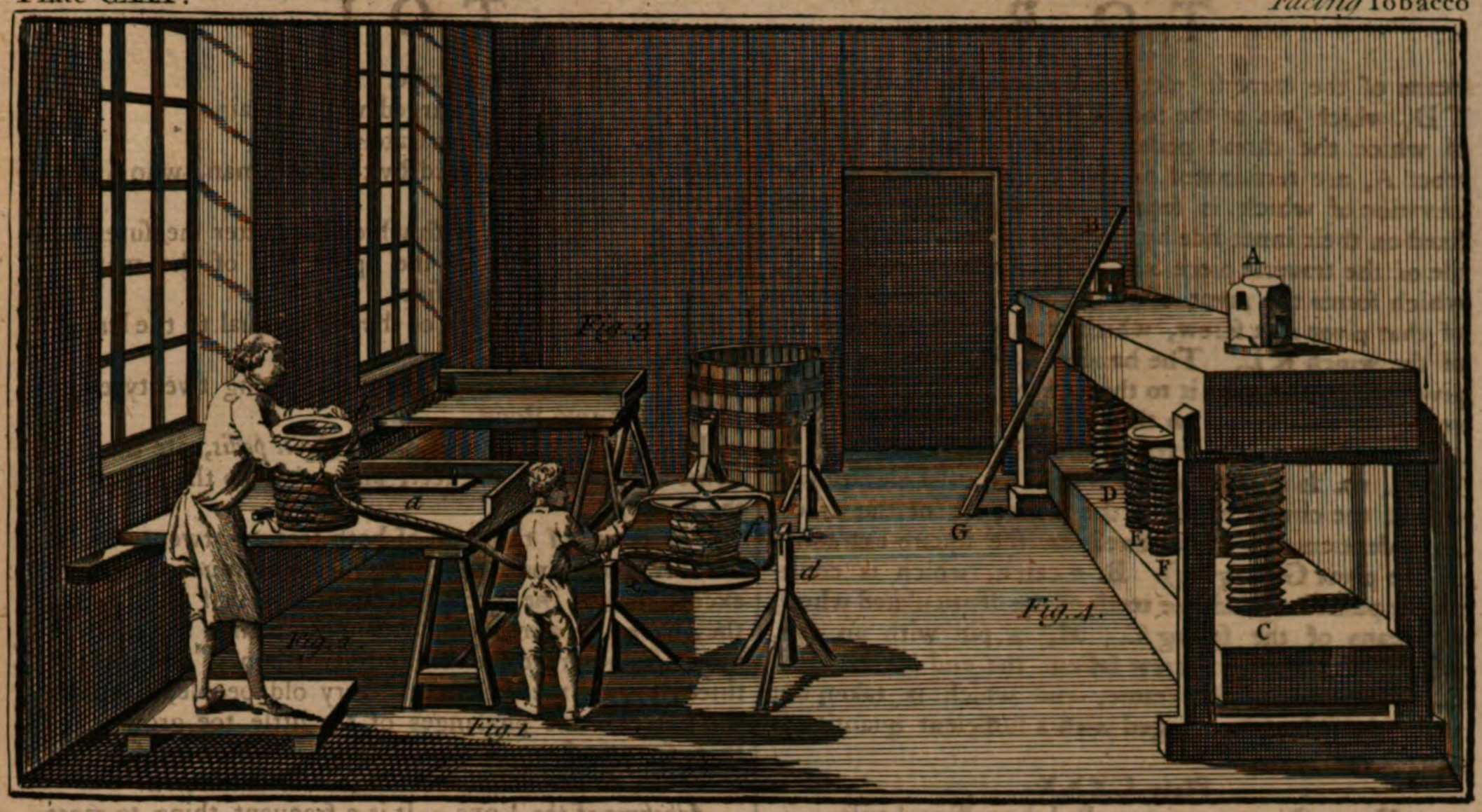
TOILS, ſnares or nets uſed by hunters for catching wild beaſts, as deer, &c.

TOILET, a fine cloth of linen, ſilk, or tapeſtry, ſpread over the table in a bed-chamber or dreſſing room, to undreſs and dreſs upon.

TOISE, a French meaſure containing ſix of their feet, or a fathom.

TOISON D'OR, a term, in heraldry, for a golden fleece, which is ſometimes borne in a coat of arms.

TOLERATION, in matters of religion, is either civil or eccleſiaſtical. Civil toleration, is an impunity and ſafety granted by the ſtate to every ſect that does not maintain doctrines inconſiſtent with the public peace: and eccleſiaſtical toleration, is the allowance which the church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A
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Fig. 1.
Fig. 4.

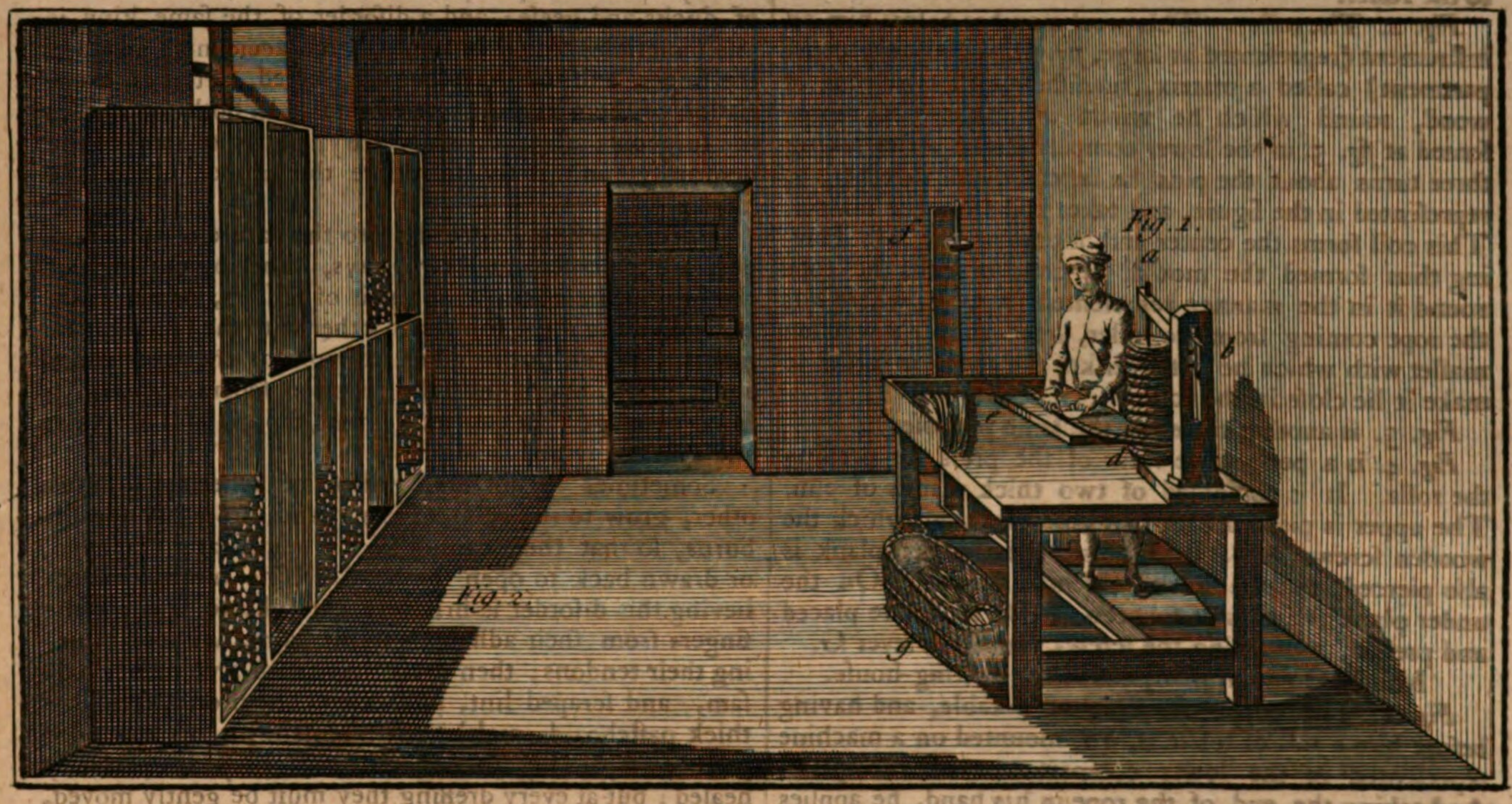
Fig. 1.
a
b
c
Fig. 2.
g

A
B
F
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H
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E
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Fig. 3.
Fig. 4.
Fig. 8.
Fig. 7.
Fig. 9.
Fig. 6.
Fig. 5.

church grants to its members to differ in certain opinions, not reputed fundamentals.

The term toleration has made a great figure in the disputes among protestants, who have been exceedingly divided about the measures of toleration, or the degrees to which heretics and schismatics are, or are not to be suffered.

TOLL, in law, denotes a tax or custom paid for passage, or for the liberty of selling goods in a market or fair. Hence, toll booth is a place in a town, where goods are weighed, in order to ascertain the duties thereon.

TOLLENON, among the Romans, a warlike machine, formed in this manner: one beam was fixed very deep in the earth, and on the top of it another, more than twice as long, and moveable upon a center; on one end of this cross-beam were placed a covering of hurdles or planks, within which a few soldiers were put, and by pulling down the other end with ropes, thele were raised above the walls of a besieged town.

TOLUIFERA, in botany, a genus of plants, the flower of which is compoled of five petals, which are inlerted into the cup; four of thele are ltraight and equal in lize, and are a little longer than the cup; but the fifth is twice as large as thele, and is cordated at the end, and has an unguis of the length of the cup. The fruit and leeds are yet unknown. It is lo called, from its producing the balam of Peru. See the article BALSAM.

TOMAN, or TOUMAN, a kind of imaginary money uled among the Perlians in the keeping of their books, and to facilitate the reduction of money in the paylment of conlilerable lums. See the article MONEY.

TOMB includes both the grave or lepulchre where in a delund is interred, and the monument erected to preleive his memory.

TOME, in matters of literature, denotes a bound book, or writing that juft makes a volume.

TOMENTUM properly lignifies ftocks or locks of wool; but by botanills is uled for that loft downy matter which grows on the leaves of lome plants.

TONE, or TUNE, in mulic, a property of lound, whereby it comes under the relation of grave and acute; or it is the degree of elevation any lound has, from the degree of fwiftnels of the vibrations of the parts of lonorous bodies.

Tone is more particularly uled for a certain degree or interval of tune, whereby a lound may be either railed or lowered from one extreme of a concord to the other, lo as ftill to produce true melody.

TONGUE, lingua, in anatomy, the primary organ of talte and fpeech; the figure of which approaches in lome degree to pyramidal; its anterior part being called apex, and its poiterior part the bale or root. The upper lide is not quite flat, but a little convex, and divided into two lateral halves, by a fhallow deprelled line called linea lingvae mediana. The edges are thinner than the other parts, and a little rounded as well as the point. The lower lide reaches only from the middle of the length of the tongue to the point.

The tongue is principally compoled of very loft fleshy fibres, intermixed with a peculiar medullary lubltance, and diploed in various manners. Many of thele fibres are continued to the tongue without going any farther; the reft form leparate muicles, which go out from it in different ways, and are inlerted in other parts: all the upper fide of the tongue is covered by a thick membrane of a papillary texture, upon which lies another very fine membrane like a kind of cuticle, which is likewile continued over the lowelt fide, but without papillæ.

Three lorts of papillæ may be diltinguilhed in the upper fide of the tongue, capitatæ, lemi-lenticulares, and villolæ. Thole of the firft kind are the largeft, relembling little muftrooms with fhort ftems, or buttons without a neck: they lie on the bafis of the tongue, in fmall fuperficial follulæ. They refemble fmall conglomerate glands, leated on a very narrow bafis, and each of them has lometimes a fmall deprelfion in the middle of their upper convex fide: they occupy the whole lurface of the bafis of the tongue, and are lituated near each other, in luch a manner, as that the moft anterior form an angle; they are glandular papillæ, or fmall falival or mucilagi-

TON

nous glands, of the lame kind with thole that are to be delcribed hereafter.

We often obleive, about the middle of this part of the tongue, a particular hole of different depths; the inner lurface of which is entirely glandular, and filled with fmall papillæ like thole of the firft kind. It is called foramen cæcum Morgagnii, as being firft delcribed by that author; lince that time Vaterus has difcovered a kind of falival ducts belonging to it; and Haller found two of thele ducts very diltinctly, the orifices of which were in the bottom of the foramen cæcum near each other. He obferved the ducts to run backward, divaricating a little from each other; and that one of them terminated in a fmall oblong veficle, lituated on the lide of the fmall cornua of the hyoides.

The papillæ of the lecond kind, or lemi-lenticulares, are fmall orbicular eminences, only a little convex, their circular edge not being leparate from the lurface of the tongue. When we examine them in a found tongue with a good microlcope, we find their convex lides full of fmall holes or pores, like the end of a thimble.

They lie chiefly in the middle and anterior portions of the tongue, and are leldomer leen well while on the edges, where they appear to be very fmooth and polilhed even to the naked eye, and leldomer in fleshy fubjects. They loon lole their confiltence after death, lo that by rubbing them leveral times, they may be drawn out in form of fmall loft pyramids inclined to one lide. The papillæ of the third kind, or villoiæ, are the fmalleft and moft numerous. They fill the whole lurface of the upper lide of the tongue, and even the interfices between the other papillæ. They would be more properly named papillæ conicæ, than villoiæ, from the figure which they appear to have, when examined through a microlcope in clear water. They are naturally lolid, but become extremely flaccid after death; lo that by handling them they may be made ihort and thick, whereas they are naturally long and fmall.

The fleshy fibres of which the tongue is compoled, and which go no farther than the tongue, may be termed muculi linguæ interiores, or the intrinlic muicles; and they are the lame with what Spigelius named muiculi linguales. The fibres thele muicles conlift of are of three leveral kinds, longitudinal, tranlverle, and vertical; and each of thele ftructures admits of different degrees of obliquity.

The longitudinal fibres point to the bafis and apex of the tongue, and leem partly to be expanlions of the muiculi itylo-glolli, hyo-glolli, and genio-glolli. The vertical fibres leem likewile to be in part produced by the lame genio-glolli, and the tranlverle by the mylo-glolli.

Belides, there mixed produftions, there is a diftinct plane of longitudinal fibres, which run near the lurface of the upper fide of the tongue, and a diftinct tranlverle plane under them. All thele fibres are partly interwoven, one portion of them terminating at the two edges of the tongue, and the other at the bafis and point, without going to any other part; and they lie immediately above thole which belong to the genio-glolli. To diicover all thele different fibres, and their different degrees of direction, we need only cut the tongue longitudinally, after it has been boiled, or long macerated in ftrong vinegar. The extrinlic muicles or muiculi exteriores, are thole which by one extremity make a part of the body of the tongue, and are fixed by the other in lome part without the tongue. Of thele we reckon four pair, mylo-glolli, ityloglolli, hyo-glolli, and genio-glolli. In plate CXXXI. fig. 1. is repreiented the human tongue, with its three integuments, which anatomills in general have omitted to remark. Bourdon, indeed, has figured them, but thicker than the life. A A A is the upper lurfaces of the tongue, on which are viiible a multitude of papillary and pyramidal eminences. B is a piece of the exterior tunic, or coat of the tongue; in which are diicernible a vaft number of nervous papillæ, adhering to its interior lurface. C C is the lecond tunic, called the corpus reticulare of Malpighi. D is the corpus reticulare of other writers. E is the membrane, or corpus papillare nervum. F F the glands of the tongue; and G the foramen cæcum ufually found in the hinder part of the tongue.

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The term toleration has made a great figure in the diſputes among proteſtants, who have been exceedingly divided about the meaſures of toleration, or the degrees to which heretics and ſchiſmatics are, or are not to be ſuffered.

TOLL, in law, denotes a tax or cuſtom paid for paſſage, or for the liberty of ſelling goods in a market or fair. Hence, toll booth is a place in a town, where goods are weighed, in order to aſcertain the duties thereon.

TOLLENON, among the Romans, a warlike machine, formed in this manner: one beam was fixed very deep in the earth, and on the top of it another, more than twice as long, and moveable upon a center; on one end of this croſs-beam were placed a covering of hurdles or planks, within which a few ſoldiers were put, and by pulling down the other end with ropes, theſe were raiſed above the walls of a beſieged town.

TOLUIFERA, in botany, a genus of plants, the flower of which is compoſed of five petals, which are inſerted into the cup; four of theſe are ſtraight and equal in ſize, and are a little longer than the cup; but the fifth is twice as large as theſe, and is cordated at the end, and has an unguis of the length of the cup. The fruit and ſeeds are yet unknown. It is ſo called, from its producing the balſam of Peru. See the article BALSAM.

TOMAN, or TOUMAN, a kind of imaginary money uſed among the Perſians in the keeping of their books, and to facilitate the reduction of money in the payment of conſiderable ſums. See the article MONEY.

TOMB includes both the grave or ſepulchre wherein a defunct is interred, and the monument erected to preſerve his memory.

TOME, in matters of literature, denotes a bound book, or writing that juſt makes a volume.

TOMENTUM properly ſignifies flocks or locks of wool; but by botaniſts is uſed for that ſoft downy matter which grows on the leaves of ſome plants.

TONE, or TUNE, in muſic, a property of ſound, whereby it comes under the relation of grave and acute; or it is the degree of elevation any ſound has, from the degeee of ſwiftneſs of the vibrations of the parts of ſonorous bodies.

Tone is more particularly uſed for a certain degree or interval of tune, whereby a ſound may be either raiſed or lowered from one extreme of a concord to the other, ſo as ſtill to produce true melody.

TONGUE, *lingua*, in anatomy, the primary organ of taſte and ſpeech; the figure of which approaches in ſome degree to pyramidal; its anterior part being called apex, and its poſterior part the baſe or root. The upper ſide is not quite flat, but a little convex, and divided into two lateral halves, by a ſhallow depreſſed line called linea linguæ mediana. The edges are thinner than the other parts, and a little rounded as well as the point. The lower ſide reaches only from the middle of the length of the tongue to the point.

The tongue is principally compoſed of very ſoft fleſhy fibres, intermixed with a peculiar medullary ſubſtance, and diſpoſed in various manners. Many of theſe fibres are confined to the tongue without going any farther; the reſt form ſeparate muſcles, which go out from it in different ways, and are inſerted in other parts: all the upper ſide of the tongue is covered by a thick membrane of a papillary texture, upon which lies another very fine membrane like a kind of epidermis, which is likewiſe continued over the loweſt ſide, but without papillæ.

Three ſorts of papillæ may be diſtinguiſhed in the upper ſide of the tongue, capitatæ, ſemi-lenticularis, and villoſæ. Thoſe of the firſt kind are the largeſt, reſembling little muſhrooms with ſhort ſtems, or buttons without a neck: they lie on the baſis of the tongue, in ſmall ſuperficial foſſulæ. They reſemble ſmall conglomerate glands, ſeated on a very narrow baſis, and each of them has ſometimes a ſmall depreſſion in the middle of their upper convex ſide: they occupy the whole ſurface of the baſis of the tongue, and are ſituated near each other, in ſuch a manner, as that the moſt anterior form an angle; they are glandular papillæ, or ſmall ſalival or mucilaginous glands, of the ſame kind with thoſe that are to be deſcribed hereafter.

We often obſerve, about the middle of this part of the tongue, a particular hole of different depths; the inner ſurface of which is entirely glandular, and filled with ſmall papillæ like thoſe of the firſt kind. It is called foramen cœcum Morgagnii, as being firſt deſcribed by that author; ſince that time Vaterus has diſcovered a kind of ſalival ducts belonging to it; and Heiſter found two of theſe ducts very diſtinctly, the orifices of which were in the bottom of the foramen cœcum near each other. He obſerved the ducts to run backward, divaricating a little from each other; and that one of them terminated in a ſmall oblong veſicle, ſituated on the ſide of the ſmall cornu of the os hyoides.

The papillæ of the ſecond kind, or ſemi-lenticulares, are ſmall orbicular eminences, only a little convex, their circular edge not being ſeparate from the ſurface of the tongue. When we examine them in a ſound tongue with a good microſcope, we find their convex ſides full of ſmall holes or pores, like the end of a thimble.

They lie chiefly in the middle and anterior portions of the tongue, and are ſometimes moſt viſible on the edges, where they appear to be very ſmooth and poliſhed even to the naked eye, and ſometimes in living ſubjects. They ſoon loſe their conſiſtence after death, ſo that by rubbing them ſeveral times, they may be drawn out in form of ſmall ſoft pyramids inclined to one ſide. The papillæ of the third kind, or villoſæ, are the ſmalleſt and moſt numerous. They fill the whole ſurface of the upper ſide of the tongue, and even the interſtices between the other papillæ. They would be more properly named papillæ conicæ, than villoſæ, from the figure which they appear to have, when examined through a microſcope in clear water. They are naturally ſoftiſh, but become extremely flaccid after death; ſo that by handling them they may be made ſhort and thick, whereas they are naturally long and ſmall.

The fleſhy fibres of which the tongue is compoſed, and which go no further than the tongue, may be termed muſculi linguæ interiores, or the intrinſic muſcles; and they are the ſame with what Spigelius named muſculi linguales. The fibres theſe muſcles conſiſt of are of three general kinds, longitudinal, tranſverſe, and vertical; and each of theſe ſituations admits of different degrees of obliquity.

The longitudinal fibres point to the baſis and apex of the tongue, and ſeem partly to be expanſions of the muſculi ſtylo-gloſſi, hyo-gloſſi, and genio-gloſſi. The vertical fibres ſeem likewiſe to be in part produced by the ſame genio-gloſſi, and the tranſverſe by the mylo-gloſſi.

Beſides theſe mixed productions, there is a diſtinct plane of longitudinal fibres, which run near the ſurface of the upper ſide of the tongue, and a diſtinct tranſverſe plane under them. All theſe fibres are partly interwoven, one portion of them terminating at the two edges of the tongue, and the other at the baſis and point, without going to any other part; and they lie immediately above thoſe which belong to the genio-gloſſi. To diſcover all theſe different fibres, and their different degrees of direction, we need only cut the tongue longitudinally, after it has been boiled, or long macerated in ſtrong vinegar. The extrinſic muſcles or muſculi exteriores, are thoſe which by one extremity make a part of the body of the tongue, and are fixed by the other in ſome part without the tongue. Of theſe we reckon four pair, mylo-gloſſi, ſtylo-gloſſi, hyo-gloſſi, and genio-gloſſi. In plate CXXXI. *fig.* 1. is repreſented the human tongue, with its three integuments, which anatomiſts in general have omitted to remark. Bourdon, indeed, has figured them, but thicker than the life. A A A is the upper ſuperficies of the tongue, on which are viſible a multitude of papillary and pyramidal eminences. B is a piece of the exterior tunic, or coat of the tongue; in which are diſcernible a vaſt number of nervous papillæ, adhering to its interior ſurface. C C is the ſecond tunic, called the corpus reticulare of Malpighi. D is the corpus reticulare of other writers. E is the membrane, or corpus papillare nervoſum. F F the glands of the tongue; and G the foramen uſually found in the hinder part of the tongue.

Fig. 2 exhibits a human tongue, in which Heiſter diſcovered two remarkable ſalival ducts, *b* and *d*, in the foramen cœcum A; *c c* is a veſicle at the extremity of the duct *d*, diſtended with ſaliva: and *e* is the place where this duct diſappeared; *f f* ſhew the courſe and ſituation of theſe ducts. The fabric and ſtructure of the oſcula, expreſſed at *b* and *d*, was ſingular, having the appearance of valves or caruncles, that had collapſed, ſo that they did not appear as repreſented in the figure, unleſs forced open by inflation: *h* is the epiglottis: *i* its anterior ligament: *k* muſcular fibres ariſing from the ſubſtance of the tongue: *l l* two little oſſicles of the os hyoides: *n n* glands and papillæ of various ſizes, about the middle of the tongue: and *o* the apex of the tongue bent downwards.

TONGUE-*tied*, the popular name for a diſtemper of the tongue in children, when it is tied down too cloſe to the bottom of the mouth, by a ligament connected all along its middle, and called its frænulum, which requires to be divided, to give the tongue its proper motion.

This is ſometimes the caſe in adults, but more frequent in children, who cannot then exert their tongue to ſuck. This is, however, by no means ſo common as the women uſually imagine; not ſo much as one child in a thouſand being afflicted with it; nor is the operation in cutting it of little conſequence, ſince often bad accidents follow it, and ſometimes the loſs of the child's life. When the infant can put its tongue out of its mouth, the frænulum wants no inciſion; but when the tongue cannot be extended beyond the teeth, the operation is neceſſary. To perform this, the end of the tongue ſhould be covered with a linen rag, and held with the fingers to prevent its ſlipping, and the ligament of the tongue running between the ranular veins and internal ſalival ducts, is to be divided by a pair of obtuſe-pointed ſciſſars, till it give room enough for ſucking or ſpeaking: but in doing this great care muſt be taken not to wound the ſalival ducts, or the proper veins and arteries of the tongue; for children have been known to periſh upon the ſpot, from the cutting the ranular veins in this operation. Midwives often tear this ligament with their fingers as ſoon as the child is born, but this is a dangerous and bad practice.

TONIC, *τονικὸς*, in medicine, is applied to a certain motion of the muſcles, wherein the fibres, being extended, continue their extenſions in ſuch a manner, as that the part ſeems immoveable, though in reality it be in motion.

TONSILS, *tonſillæ*, in anatomy, two remarkable glands ſituated one on each ſide of the mouth, near the uvula, and commonly called almonds of the ears, from their reſembling almonds in figure.

Their uſe is to ſecrete a mucous humour for lubricating the paſſages: this they diſcharge by ſeveral irregular but conſpicuous foraminæ into the mouth.

The tonſils are apt to be inflamed from taking cold, for which Heiſter firſt adviſes a gentle purge of tamarinds, ſena, and cream of tartar; and this is to be repeated to the third or fourth doſe, if there be occaſion: in the intermediate times, the diaphoretic, attemperating, and nitrous medicines are to be given in powders, and a large quantity of diluting liquors allowed, which ſhould be gently acidulated, and have a ſmall quantity of nitre diſſolved in them: gargariſms made of decoctions of biſtort-root, red-roſes, and other gentle aſtringents, are alſo to be frequently uſed; and the frequent waſhing the feet in warm water, often has a very remarkable good effect.

If after four or five days the diſtemper is found not to give way to theſe means, but the tumour ſtill remains, there is then but little hopes to be had of its reſolution, and a very different end is to be attempted: emollient gargariſms are now to be uſed, and maturating plaſters externally applied, ſuch as diachylon with the gums, and the like; and ſuppurating cataplaſms are to be applied to the whole neck and throat: theſe methods are to be continued till the tumour either burſts of itſelf, or is ſo ripe as to be fit for opening by the hand of the ſurgeon. After this has been done, and the matter is diſcharged, gargariſms muſt be uſed of decoctions of ſome vulnerary herb; or common green tea, ſweetened with honey of roſes, may be uſed to ſerve the purpoſe. The mouth and throat are to be frequently waſhed with this till the part is healed. It is to be obſerved, however, that the reſolution of theſe tumours is never to be deſpaired of, not even during the uſe of the ſuppurating medicines, for it is often ſeen that the tumour has been wholly diſcuſſed even during the uſe of theſe means, the reſolution often being extremely ſlow.

This is a very troubleſome complaint, and with ſome perſons is apt to return very frequently; the beſt preſervative againſt it is a moderate diet and bleeding, about the time of the equinoxes, either in the arm or foot. Some have found it neceſſary to open an iſſue in the arm, in this caſe, and have been by this means perfectly cured; but on its drying up have always found the diſeaſe return.

TONSURE, in eccleſiaſtical hiſtory, a particular manner of ſhaving or clipping the hair of eccleſiaſtics or monks.

The antient tonſure of the clergy was nothing more than polling the head, and cutting the hair to a moderate degree, for the ſake of decency and gravity: and the ſame obſervation is true with reſpect to the tonſure of the antient monks. But the Romaniſts have carried the affair of tonſure much farther; the candidate for it kneeling before the biſhop, who cuts his hair in five different parts of the head, viz. before, behind, on each ſide, and on the crown.

TOOL, among mechanics, denotes in general any ſmall inſtrument, uſed as well for making other more complex inſtruments and machines, as in moſt operations in the mechanic arts.

TOOTH, *dens*, in anatomy, a little, hard, ſmooth bone ſet in the gums, and ſerving to maſticate or chew the food, &c.

As every part of the human body loudly proclaims the ineffable wiſdom and diffuſive goodneſs of its glorious architect and contriver; ſo alſo the teeth, their exquiſite order, and curious ſtructure, are ſo many proofs richly pregnant with irrefragable arguments for the ſtupendous and amazing power of the venerable Being who formed them. The firſt memorable circumſtance which occurs with reſpect to the nature of theſe ſubſtances is, that in hardneſs and durable texture they far ſurpaſs all other parts of the body. Hence, according to Tertullian, in his treatiſe De Reſurrectione, the miſtaken piety of the ancients induced them to bury the teeth in the earth, ſince they remained ſound for ſeveral hundreds or thouſands of years; and their deſign in this practice was to render the body entire at the reſurrection. When we reflect upon the beautiful order and diſpoſition with which they are ranged in the extremities of both maxillæ, or jaw-bones, we cannot fail to be ſtruck with awful impreſſions of the exquiſite ſkill and curious contrivance with which they are formed; for they are ſo ſituated, that the ſuperior and inferior rows are indeed capable of being joined, though not all at one and the ſame time, that by this means the actions of inciſion and maſtication may be varied at pleaſure; for when the dentes molares are joined, the anterior teeth of the ſuperior row project beyond, and partly cover their correſponding teeth of the inferior row. But when the extremities or points of the anterior teeth are joined, the dentes molares remain at a diſtance from each other, by which means they enjoy reſt, and are ſubjected to action reciprocally, and by turns. This ſurpriſing inſtance of art and deſign long ago appeared to Galen, as we learn from his treatiſe De Oſſibus, abundantly ſufficient to refute thoſe ludicrous calumniators of Nature, who aſcribe the moſt curious of her productions to a caſual and fortuitous concourſe of atoms. Without this mill, as it may be called, of the microcoſm, a due maſtication, which as Helmont excellently obſerves, in his treatiſe de Victus Ratione, greatly contributes to the preſervation of life, cannot be performed.

We ſhall therefore at preſent conſider their nature and ſtructure, their connection and uſe, the ſeveral cauſes by which they are injured, and the various medicines accommodated to remove the misfortunes and indiſpoſitions to which they are ſubject. Omitting therefore too minute and prolix diſquiſitions with reſpect to the name, we ſhall only obſerve, that in former ages they were called *dentes*, as it were from *edentes*. The teeth then are bony parts of the body, conſiſting of two ſubſtances, the one intenſely hard, and as it were of a ſtrong texture, and the other ſofter, but alſo of a bony nature. Internally they

they are furniſhed with a certain cavity; they are fixed in the ſockets of the maxillæ, by that particular ſpecies of articulation called gomphoſis; and are deſtined for the purpoſes of maſtication, articulation of the voice, and ornament. Firſt, then, we are to obſerve, that the teeth conſiſt of two ſubſtances, the exterior of which is highly hard like a ſtone, though it does not partake of a ſtony nature; as is obvious from putting an entire human tooth into a ſufficient quantity of aqua fortis for ſome hours, by which it is entirely diſſolved, whilſt there remains a very ſmall quantity of a glutinous ſubſtance, which ſeems to be a ſulphureous and ſomewhat pinguious portion of the teeth. If to the ſolution, when ſufficiently ſaturated, we add oil of tartar per deliquium, there is produced a highly white magiſtery, in medicinal virtues agreeing with that prepared from the boar's teeth, or the elk's hoof. But ſuch a chemical ſolution cannot be produced with reſpect to flints and genuine ſtones. The exterior ſubſtance, however, of the teeth is ſo hard and ſolid, that by a violent attrition or concuſſion with iron, it emits large quantities of ſparkles. But this only holds true with reſpect to the dentes molares of the larger animals, which are capable of making a conſiderable reſiſtance. This hard and ſtony part of the teeth is only obſerved in thoſe portions of them which lie without the ſockets of the gums, and like a bark or covering ſurround the bony part of the teeth; for the roots of the teeth, which are concealed in the ſockets and gums, are only of a bony nature, and conſequently of a colour not ſo white and ſplendent as the external part which is uncovered. But the external part is the hardeſt, not only that it may be proof againſt wounds and injuries, but alſo, that it may be the better qualified for inciding and breaking the aliments. The interior bony matter, on account of the greater laxity of its pores, is more eaſily diſſolved and conſumed: Hence it is covered with an external harder bark, leſt, perhaps, ſome of the more acrid and corroſive parts of the aliments ſhould injure or deſtroy it. This internal ſubſtance of the teeth is that part principally affected in a caries; for the external covering is rarely ſeen totally, but only partially conſumed: beſides, the ſtructure of the external ſtony covering of the teeth differs from that of the internal part; for in the former, the ſtriæ, or furrows, terminate obliquely in ſmall circles; but the interior ſofter part of the teeth conſiſts of ſeveral layers of fibres, longitudinally laid over each other. When a reſolution is made by a long maceration of the bones, theſe layers become ſufficiently conſpicuous; for the bony reticular plates may by this means be ſeparated entire.

Anatomiſts have obſerved, that a certain cavity is formed in the teeth, which is ſufficiently conſpicuous when a tooth is cut longitudinally in the middle; on which occaſion we obſerve, that all the roots of the teeth are furniſhed with that peculiar cavity, which is very conſiderable in the baſe of the tooth itſelf, or that part of it which appears without the gums; for in the cavities of the teeth of every animal, there is always found a mucous, membranaceous ſubſtance, or a certain ſmall mucous end, in the form of an oblong bladder, compoſed of highly ſlender blood-veſſels, nervous membranes, and a certain glutinous ſubſtance. This alſo reaches to the very extremities of the teeth, where its membranes being more contracted, it appears ſomewhat harder and redder. In fœtuſſes and children this cavity is ſufficiently large, and according to Euſtachius, in his treatiſe de Dentibus, divided till the ſeventh year of their age like honeycombs; but it is ſmaller in adults. In children this cavity is filled with a mucous matter, ſurrounded with a membrane whoſe external ſurface is reddiſh, but internally it appears more white; and the mucus itſelf, being the general nouriſhment of the teeth, is at laſt converted into their ſubſtance; for we obſerve, the more ſolid and firm the ſubſtance of the teeth becomes, as in adults, the ſmaller quantity of this mucus is found; whereas, in infants whoſe teeth conſiſt of ſmall and tender laminæ, a large quantity of it is obſervable. In the teeth of calves, eſpecially what is called the ſweet-tooth, this matter may be commodiouſly ſeen with the naked eye: in its ſurface ſome traces of blood diſcover themſelves by a reddiſh colour; and, when the mucous matter is compreſſed, it actually diſcharges blood.

All the teeth without exception, are ſo firmly fixed in their ſockets, like ſo many wedges, by that ſpecies of articulation called gomphoſis, that in maſtication they remain ſteady and immoveable. Beſides, the teeth are not all fixed in their ſockets by an equal number of roots, for the inciſores are only ſecured by one: the canini have alſo but one, which, however, is deeper than thoſe of the inciſores, and larger in proportion to the ſtrength of the canini. And among the inciſorii, the two in the middle are ſecured by deeper roots than the two lateral ones contiguous to the canini, becauſe they are broader and larger. The dentes molares differ from each other with reſpect to their roots: the ſuperior, and eſpecially the two poſterior, are ſometimes fixed with three roots, but the inferior have only two, partly becauſe the ſubſtance of the ſuperior jaw is ſofter and leſs compact than that of the inferior, for which reaſon they could not be ſo ſecurely fixed by two as by three roots; and partly becauſe the inferior preſs upon their roots by their own weight, whereas the ſuperior are pendulous, and conſequently require more roots to ſecure them.

The other dentes molares, ſucceeding the dens caninus in the upper jaw, have two roots, and thoſe in the inferior only one. Beſides, it is to be obſerved, that the teeth of children are only furniſhed with imperfect, ſoft, and as it were medullary roots: hence they are generally looſe, eſpecially the inciſores, which may be pulled out with one's nails, or by a piece of thread twiſted about them. It is alſo to be obſerved, that the roots of the teeth are internally ſurrounded with membranous and nervous ligaments, by which the teeth are firmly ſecured in their ſockets; and externally the teeth are encompaſſed by the ſubſtance of the gums, which are a kind of hard fleſh, conſiſting of ſmall fibrous laminæ placed cloſe to each other, and intermixed with a large number of blood-veſſels, for which reaſon they are intenſely red. They are beſides liberally furniſhed with ſlender membranes, glands, and ramifications of nerves; hence they derive their power of ſenſation, and are obſerved to be moiſtened with a due humidity. This fleſh ſurrounds the teeth like a rampart, and fortifies them as muſcles do: hence, when it is either eat away, or become preternaturally flaccid, the teeth generally become looſe, or drop out; but the membrane which ſurrounds the roots of the teeth, and that part of them which is covered, as Clopton Havers in his Oſteology juſtly obſerves, is not a continuation of the maxillary perioſteum, but rather a propagation of that membrane which is contiguous to the gums, and is common to the whole mouth, which is really glandular, and which does not terminate with the gums, but as ſoon as it arrives at their margins, is intorted and reflected betwixt the inſide of the gum and the tooth; but it deſcends into the ſockets, and adheres immediately to thoſe parts of the teeth which are lodged in them. From the root of ſome teeth, eſpecially thoſe of the upper jaw, together with this membrane, there is ſomething of a hard and fleſhy nature communicated to the ſubſtance of the gums, by which the teeth are more ſecurely fixed in their ſockets. And though the teeth themſelves do not partake of the common perioſteum, yet their ſockets are furniſhed with it, and it ſo coaleſces and unites with the membrane which covers the teeth, that they ſeem to form but one and the ſame body.

From a peccant nouriſhment proceed theſe concretions about the teeth and gums, which are commonly called the tartar of the teeth. Helmont is of opinion, that the gums ſupply the teeth with nouriſhment; and when this nutritive juice is excrementitious, and diſcharged from the injured gums, it indurates about the teeth, and aſſumes a degree of hardneſs almoſt equal to their own. However, it is probable that the tartareous matter adhering to the teeth is produced partly from the ſaliva, impregnated with the terreſtrial tartareous lymph of the gums, which by continually moiſtening the teeth, gradually adds viſcid and tartareous particles to them.

This tartar, in conſequence of its acrimony, gradually conſumes the ſubſtance of the teeth, induces a blackneſs, and ſometimes a caries. This tartareous ſubſtance is inſtantaneouſly reſolved by being rubbed with ſpirit of ſalt, which is a proof that it conſiſts of an alkaline earth. This diſorder is generally moſt incident to infants, and children

dren who feed upon viſcid preparations of milk and ſweetmeats, as alſo to ſcorbutic, arthritic, nephritic, and hypochondriac patients; becauſe their ſerum abounds with impure, terreſtrial, and tartareous parts. For this reaſon phyſicians ought carefully to inſpect the teeth, becauſe by their ſtate that of the ſerum and lymph are moſt ſatisfactorily diſcovered.

TOOTH-*Ach.*—The tooth-ach ſeems to be a particular ſpecies of rheumatiſm; for, in practice, we often obſerve pains of the joints, ſcapulæ, and ſhoulders, tranſlated to one ſide of the head, the teeth of which they attack in a moſt violent manner. On the contrary, pains of the head and teeth are obſerved frequently to change their ſeat and fall down upon the ſhoulders, arms, and the ſcapulæ. As a rheumatiſm is produced by an intemperature or ſudden change of air, ſo alſo a tooth-ach is generally excited in ſuch as are previouſly diſpoſed to it, eſpecially if they happen to be of a cacochymic habit, by their ſuddenly removing from a warm to a cold air; or by the ſudden viciſſitudes of heat and cold in the ſpring and autumn. As rheumatiſms are more incident to women than men, ſo alſo are tooth-achs, and that for the ſame reaſons: beſides, though theſe two diſorders are leſs frequently incident to men than women, yet they generally prove far more ſevere in the former than in the latter. There is a certain analogy not only between a rheumatiſm and a tooth-ach, but alſo between a tooth-ach and a gout; for as arthritic diſorders are accompanied with pain, redneſs, ſwelling, and a ſlight fever, ſo the ſame ſymptoms are obſerved to attend a tooth-ach. Beſides, it is confirmed by experience, that ſuch as are ſubject to rheumatic or arthritic diſorders are rarely afflicted with tooth-achs, but for the moſt part have their teeth ſound and entire: whereas thoſe that are free from thoſe diſorders of the muſcles and joints, are generally for that reaſon more ſubject to tooth-achs. As in rheumatiſms and gouts, ſo in tooth-achs, thoſe who have been once afflicted are eaſily, and by every ſlight cauſe, ſubjected to freſh attacks of the diſorder, on account of the weakneſs which theſe diſorders generally leave in the parts; ſo that a gout, rheumatiſm, and a tooth-ach ſeem to be but one and the ſame diſeaſe appearing with different degrees of ſtrength, attacking different parts, and therefore accompanied with ſymptoms ſeemingly different, though produced by one common cauſe. Hence it follows, that the regimen and method of living proper in one of theſe diſorders, muſt of courſe be in the other alſo: but theſe things are ſo obvious to every perſon who will only allow himſelf to think, that there is no neceſſity for a longer or more explicit illuſtration of them. When tooth-achs are ſo intenſely violent, as to reſiſt the force and elude the efficacy of all other medicines, Hoffman tells us that he has obſerved a very ſingular and unexpected relief afforded by the following pills invented by himſelf.

Take of the pilulæ aloephanginæ one dram, of the pilulæ de ſtyrace half a dram, and of the extract of ſaffron ſix grains; mixt up into a maſs, of which form ſixty pills; ſix or eight of which are to be exhibited for a doſe.

Sometimes tooth-achs are ſo violent and intolerable, that they obſtinately reſiſt the beſt choſen and moſt efficacious medicines, in which caſe the means of relief are only to be obtained from manual operation: for, firſt, the pains are either to be alleviated by ſcariſying the gums, as Pliny, in the ſeventh chapter of his thirty-ſecond book, has long ago obſerved; and this method is frequently practiſed; or ſecondly, an actual cautery, adapted to this end, is to be plunged into the cavities of the carious teeth: or thirdly, the part behind the ear, by anatomiſts called antitragus, is to be cauterized, or have an inciſion made in it; or, according to Schelhammer, it is to be ſtrongly compreſſed with the fingers: or, in the fourth and laſt place, the corrupted and carious tooth is to be extracted.

As to the cleanſing of foul teeth, ſee the article DENTIFRICE.

TOOTH-DRAWING, the operation of pulling out a carious, or otherwiſe injured tooth.

This art, according to Cicero, was invented by Æſculapius, in whoſe temple the antients hung up a pair of leaden pullicans, very properly ſignifying that no teeth were fit to be pulled out, but ſuch as might be removed with a leaden forceps; that is, ſuch as were looſe and ready to fall out of themſelves; for they very little conſult their own welfare, who pull out their teeth while firm and ſound: for drawing the teeth is not only a painful operation, but often brings on bad accidents, and ſometimes even hazards the patient's life.

Tooth-drawing, however wrong in many caſes, yet is certainly right and neceſſary in others. 1. In children, for the removing their lacteal, or deciduous teeth; for when theſe are left too long in their ſockets, they diſplace the new ones, and turn them awry. 2. In infants it is alſo neceſſary to draw ſuch teeth as grow out of the palate; or out of improper parts of the mouth, and are placed ſo as to impede their ſpeaking or ſucking. 3. In the tooth-ach proceeding from a tooth's being carious, and giving way to no medicines, drawing is the laſt reſort, and is abſolutely neceſſary. 4. Thoſe teeth ought to be drawn which by their irregular figure and poſition lacerate the gums and lips, and cannot be brought into ſhape by the file. And laſtly, it is ſometimes neceſſary to draw a tooth for the curing a fiſtula, or ulceration of the gums near the roots of the teeth.

The regular method of drawing them is this: if the tooth is in the lower jaw, the patient muſt be ſeated on a low ſeat, or on the floor, and if in the upper jaw, he muſt be placed on a high ſtool or table; then the proper inſtrument is to be ſelected, and the tooth carefully drawn as a nail out of a piece of wood. But this muſt never be done while the gums are inflamed, ſwelled, or otherwiſe diſtempered.

TOP *of a Ship*, a round frame of boards lying upon the croſs-trees near the head of the maſt; here they furl and looſe the top-ſail, &c.

TOP-ARMOURS *in a Ship of War*, are a kind of cloths hung about the round-tops of the maſts for ſhew; and alſo to hide the men which are on top in a fight, who lie there to fling ſtink-pots, &c. or to fire ſmall ſhot down on the enemy, in caſe of boarding.

TOP-MASTS *of a Ship*, are four, which are made faſt and ſettled unto the heads of the main-maſt, fore-maſt, mizzen-maſt, and bow-ſprit reſpectively.

TOP-GALLANT-MASTS *of a Ship*, are two, viz. main-top-gallant-maſt and fore-top-gallant-maſt, which are ſmall round pieces of timber, ſet on their reſpective top-maſts; on the top of which maſts are ſet the flag-ſtaffs, on which the colours, as flags, pendants, &c. hang.

TOP-ROPES *of a Ship*, are thoſe with which the top-maſts are ſet or ſtruck; they are received through a great block which is ſeized on one ſide under the cap, and then are reeved through the heel of the top-maſt, where is a braſs ſhiver placed athwart ſhips; after this they are brought up and faſtened on either ſide the cap with a ring: the other part of them comes down by the ties, and ſo is reeved into the knight-head; and, when it is to be heaved, it is brought to the capſtan. Theſe top-ropes belong only to the main and fore-maſt.

TOP-SAILS and TOP-GALLANT-SAILS *of a Ship*, are thoſe belonging to the top-maſts and top-gallant-maſts.

TOP, A-STARBOARD, on board a ſhip, a word of command to hale upon the larboard liſt.

TOP *the Yard-arms*, on board a ſhip, a word of command to make the yards hang higher or lower.

TOPARCHY, a little ſtate or ſeigniory, conſiſting only of a few cities or towns; or a petty country, governed and poſſeſſed by a toparch or lord.

TOPAZ, in natural hiſtory, a gem called by the ancients chryſolite, as being of a gold-colour.

The topaz, when perfect and free from blemiſhes, is a very beautiful and valuable gem; it is, however, very rare in this ſtate. It is of the number of thoſe gems which are found only in the round or pebble form, there never having been yet ſeen a true and genuine topaz of a columnar figure, though the far greater part of what our jewellers call ſuch, are in that form. The greateſt part of the true topazes are no larger than grains of a coarſe ſeed; among theſe there are, however, ſome met with of the ſize of a pea, and ſome much larger; thoſe are very rare.

It

It is of a roundiſh or oblong figure in its native or rough ſtate, and uſually is flatted on one ſide, and is generally of a bright and naturally poliſhed ſurface, tolerably tranſparent. They are ever of a fine yellow colour; but they have this, like the other gems, in ſeveral different degrees: the fineſt of all are of a true and perfect gold-colour; but there are ſome much deeper, and others extremely pale, ſo as to appear ſcarce tinged.

The oriental topaz is equal to the ruby in hardneſs, and is ſecond only to the diamond in luſtre. The topazes of the other parts of the world fall off greatly from this hardneſs, but the pureſt of the genuine ones are conſiderably harder than cryſtal.

The topaz, on being thrown into a charcoal fire, entirely loſes its colour, and when taken out, is a very fine colourleſs ſtone, undiſtinguiſhable from that known by the name of the white ſapphire: upon the whole it appears, that the oriental coloured gems are all much alike in their matter, differing ſcarce at all, except in colour, and that when they are found either naturally colourleſs, or rendered ſo by art, it is not eaſy to diſtinguiſh one of them from the other.

The fineſt topazes in the world are found in the Eaſt-Indies, but they are very rare there of any great ſize: the Great Mogul, however, at this time, poſſeſſes one, which is ſaid to weigh 157 carats, and to be worth more than 20,000l. The topazes of Peru come next after theſe, in beauty and in value; the European are principally found in Sileſia and Bohemia, and are generally full of cracks and flaws, and of a browniſh yellow.

Beſides all theſe degrees of value in the genuine topazes, our jewellers keep what they call a kind of them, inferior greatly to the true ones; all theſe are common hexangular cryſtals, coloured to a paler or deeper yellow in mines: theſe they cut into ſtones for rings, and ſell under the name of topazes; and moſt of the ſtones we ſee under that name are ſuch.

The antients have ſaid much of the topaz's virtue: it is ſaid to be a high cordial and ſudorific, and to have been given alſo in hæmorrhages with great ſucceſs. But whatever virtues it may poſſeſs, we are not to expect to find them in the ſtones our druggiſts now keep under the name of topazes, theſe being no other than fragments of a yellowiſh plated ſpar, common in lead mines, and impregnated more or leſs with that metal.

The topaz itſelf ſeems to owe its colour to lead, but the quantity it contains of that is ſo very inconſiderable, that it can be of no effect in the body, and may very well be ſuppoſed to leave it in the ſtate of cryſtal; which ſeems as much as we are to imagine really of any of the gems; but this ſpar, ſold in the place of topaz, not only diſcovers that it holds a great deal of lead by its weight, but lead has actually been ſeparated from it, in no leſs quantity than one fifth of its weight.

TOPHUS, in medicine, denotes a chalky or ſtony concretion in any part of the body, as the bladder, kidneys, &c. but eſpecially in the joints.

TOPIC, in rhetoric, denotes a probable argument, drawn from the ſeveral circumſtances of a fact, &c. Hence the art of finding and managing ſuch arguments, is called by the antients *topica*, τοπικη.

TOPICS, or TOPICAL MEDICINES, are the ſame with external ones, or thoſe applied outwardly to ſome diſeaſed and painful part: ſuch are plaſters, cataplaſms, unguents, &c.

TOPOGRAPHY, a deſcription or draught of ſome particular place, or ſmall tract of land, as that of a city or town, manor or tenement, field, garden, houſe, caſtle, or the like; ſuch as ſurveyors ſet out in their plots, or make draughts of, for the information and ſatisfaction of the proprietors.

TORCH, *Tæda*, a luminary uſed in ſeveral church-ceremonies, funerals, &c. and more uſually called a flambeau.

TORCULAR, in ſurgery, the ſame with the tournequet. See TOURNEQUET.

TORDYLIUM, in botany, a genus of plants, the flower of which is umbellated; and the principal umbel is compoſed of many ſmall ones, compounded of many rays; the involucrum of the greater umbel is compoſed of narrow leaves, as long as the rays of the umbel; thoſe of the rays are half the length; the umbels are deformed; the flowers have five heart-ſhaped inflexed petals, which are equal; they have each five hair-like ſtamina terminated by ſingle ſummits, and a roundiſh germen, ſituated under the flower, ſupporting two ſmall ſtyles crowned by obtuſe ſtigmas. The germen afterward turn to a roundiſh compreſſed fruit longitudinally indented, dividing in two parts, each containing one roundiſh compreſſed ſeed with an indented border.

Mr. Miller enumerates eight ſorts of this plant, and ſays, they may be all termed annual, becauſe they do not live more than one year; but ſome of them are called biennial, from the young plants which come up in autumn, living through the winter, and producing their flowers and fruits the following ſummer; but, as the ſeeds which are ſown, or permitted to ſcatter, perfect their ſeeds in the compaſs of one year, they ſhould be termed annual; for this is the property of many of the plants with umbellated flowers, whoſe ſeeds ſhould be ſown in autumn, otherwiſe, if they come up, which frequently does not happen the ſame year when they are ſown in the ſpring, the plants generally decay before their ſeeds ripen; but, as their whole growth is performed within the year, they ſhould be eſteemed as annual plants.

They are propagated by ſeeds, which ſhould be ſown in autumn ſoon after they are ripe, when the plants will ſoon appear, and are very hardy, ſo that they require no further care, but to keep them clear from weeds; and where they come up too cloſe together, they ſhould be thinned ſo as to leave them ſix inches aſunder. In June following the plants will flower, and their ſeeds will ripen in autumn, which, if permitted to ſcatter on the ground, will produce a ſupply of plants without any trouble. Theſe plants will grow on any ſoil or ſituation, ſo may be put into any obſcure part of the garden.

TORE, *Torus*, in architecture, a large round moulding, uſed in the baſes of columns.

TORCUMATOGRAPHY, a Greek term, ſignifying the knowledge or rather deſcription of ancient ſculptures and baſſo-relievos.

TOREUTICE, τορευτικη, that part of ſculpture otherwiſe called turning.

TORIES, or TORYS, in the hiſtory of England, a faction or party oppoſed to the whigs.

The tories are great ſticklers for the prerogative of the crown, as the whigs are for the liberties and privileges of the people: though, in truth, the principles of the moderate people of both parties do not greatly differ.

TORMENTIL, in botany, a genus of plants, with a roſaceous flower, conſiſting of four obverſely cordated, plane, and patent petals; the ſtamina are ſixteen ſubulated filaments, about half the length of the cup; the ſeeds are eight in number, oblong, obtuſely acuminated, and contained in the cup, which forms a kind of globoſe capſule.

Tormentil-root has an auſtere ſtyptic taſte, accompanied with an aromatic flavour: it is one of the moſt agreeable and efficacious vegetable aſtringents: there are alſo a tincture and a diſtilled water of it, the former of which poſſeſſes all the virtues of the ſimple.

TORMINA, in medicine, a term ſometimes uſed to expreſs pain in general, but more particularly a ſpecies of pain called tormina ventris, or alvi, in Engliſh the gripes.

TORNADO, or TURNADO, a ſudden and violent guſt of wind from all points of the compaſs, frequent on the coaſt of Guinea.

TORPEDO, in natural hiſtory, a ſea fiſh, famed, both among the ancient and modern naturaliſts, for a remarkable numbneſs wherewith it ſtrikes the arm of thoſe that touch it.

The torpedo is a flat fiſh, much reſembling the thornback; ſufficiently deſcribed in moſt treatiſes of fiſhes, and commonly found among the coaſts of Provence, Gaſcony, &c. where the people eat it without danger.

Upon touching the torpedo with the finger, it frequently, though not always happens, that the perſon feels an unuſual painful numbneſs, which ſuddenly ſeizes the arm up to the elbow, and, ſometimes, to the very ſhoulder or head.

The pain is of a very particular ſpecies, and not to be deſcribed by any words: yet Meſſieurs Lorenzini,

Borelli, Redi, and Reaumur, who all felt it ſeverely, obſerve it to bear ſome reſemblance to that painful ſenſation felt in the arm, upon ſtriking the elbow violently againſt a hard body: though, M. Reaumur aſſures us, this gives but a very faint idea of it.

Its chief force is at the inſtant it begins; it laſts but a few moments, and then vaniſhes entirely. If a man do not actually touch the torpedo, how near ſoever he holds his hand, he feels nothing: if he touch it with a ſtick, he feels a faint effect: if he feels it through the interpoſition of any pretty thin body, the numbneſs is felt very conſiderably; if the hand be preſſed very ſtrong againſt it, the numbneſs is the leſs, but ſtill ſtrong enough to oblige a man ſpeedily to let go.

M. Reaumur accounts for the phænomena of the torpedo in this manner:—The torpedo, like other flat fiſhes, is not abſolutely flat, but its back, or rather, all the upper part of its body, a little convex: when it did not, or would not produce any numbneſs in ſuch as touched it, its back, he found, always preſerved its natural convexity; but whenever it would diſpoſe itſelf to reſent a touch or thruſt, it gradually diminiſhed the convexity of the back parts of the body; ſometimes only rendering them flat, and ſometimes even concave.

The very next moment the numbneſs always begins to ſeize the arm; the fingers that touched, were obliged to give back, and all the flat and concave part of the body was again ſeen convex: and whereas it only became flat inſenſibly, it returned to its convexity ſo ſwiftly, that one could not perceive any paſſage from the one to the other ſtate.

The motion of the ball out of a muſket is not, perhaps, much quicker than that of the fiſh re-aſſuming its ſituation; at leaſt, the one is not more perceivable than the other.—It is from this ſudden ſtroke that the numbneſs of the arm ariſes, and accordingly the perſon, when he begins to feel it, imagines that his fingers have been violently ſtruck. It is the mere velocity of the ſtroke that produces the numbneſs.

The wonder is, how ſo ſoft a ſubſtance as that of the fiſh ſhould give ſo rude a blow: indeed, a ſingle ſtroke of a ſoft body could never have done it, but, in this caſe, there is an infinity of ſuch ſtrokes given in an inſtant.

To explain the admirable mechaniſm thereof, we muſt give a view of the parts whereon it depends.—This mechaniſm then, depending, conſiſts in two very ſingular muſcles deſcribed by ſeveral authors who have given the anatomy of the torpedo. Redi, and after him Lorenzini, call them the muſculi falcati; their form is that of creſcents, and they, together, take up almoſt half the back of the fiſh, the one on the right ſide, and the other on the left. Their origin is a little above the mouth, and they are ſeparated from each other by the bronchia, into the laſt of which they have their inſertions.—What is ſingular in them is their fibres, if, with the authors abovementioned, we may give that name to a ſort of ſmaller muſcles as big as gooſe quills, of an aſſemblage of which the two great muſcles are formed. Theſe leſſer muſcles are hollow cylinders, their length nearly equal to the thickneſs of the fiſh, and ranged aſide of each other; all perpendicular to the upper and lower ſurfaces of the fiſh, accounting theſe ſurfaces as two nearly parallel planes. The exterior ſurface of each of theſe cylinders conſiſts of whitiſh fibres, whoſe direction is the ſame with that of the cylinder: but theſe fibres only form a kind of tube, whoſe parietes are not above the thickneſs of a leaf of paper. The cavity of the tube is full of a ſoft matter, of the colour and conſiſtence of pap, divided into twenty-five or thirty different little maſſes, by ſo many partitions, parallel to the baſe of the cylinder; which partitions are formed of tranſverſe fibres: ſo that the whole cylinder is, in ſome meaſure, compoſed of twenty-five or thirty ſmaller cylinders placed over each other, and each full of a medullary ſubſtance.

We need only now remember, that when the torpedo is ready to ſtrike its numbneſs, it ſlowly flattens the outer ſurface of its upper part, and the whole mechaniſm whereon its force depends will be apparent. By that gradual contraction it bends, as it were, all its ſprings; renders all its cylinders ſhorter, and at the ſame time, augments their baſis; or, which amounts to the ſame, ſtretches all the little incloſures which divide the ſoft matter. In all probability too, the large fibres, or little muſcles, in that moment loſe their cylindrical form, to fill the vacuities between them.

The contraction being made to a certain degree, all the ſprings unbend, the longitudinal fibres are lengthened, the tranſverſe ones, or thoſe which form the incloſures, are ſhortened; each incloſure, drawn by the longitudinal fibres which are lengthened, drives the ſoft matter it contains upwards, in which it is apparently aſſiſted by the undulatory motion which is in the tranſverſe fibres, when contracting.

If then a finger touch the torpedo, it inſtantly receives a ſtroke, or, rather, ſeveral ſucceſſive ſtrokes from each of the cylinders wherein it is applied. As the ſoft matter is diſtributed into divers incloſures, it is more than probable all the ſtrokes are not given preciſely at the ſame moment: nay, were there no incloſures to ſeparate the matter, its impreſſure would give ſtrokes, in ſome meaſure, ſucceſſive; for all parts of ſoft bodies do not ſtrike at once; the impreſſion of the laſt does not take till after the firſt have done acting. But theſe ſeveral incloſures ſerve to augment the number of the ſprings, and, of conſequence, the velocity, and force of the action. Theſe quick re-iterated ſtrokes given by a ſoftiſh matter, ſhake the nerves, ſuſpend or change the courſe of the animal ſpirits, or ſome fluid equivalent: or, if you had rather, theſe ſtrokes produce an undulatory motion in the fibres of the nerves, which claſhes or diſagrees with that they ſhould have in order to move the arm; and hence the inability we are under of uſing the ſame, and the painful ſenſation which accompanies it.—Hence it is, that the torpedo does not convey its numbneſs to any degree, except when touched on theſe great muſcles; ſo that the fiſh is very ſafely taken by the tail, which is the part by which the fiſhermen catch it.

The authors who have accounted for the effect of the torpedo from torporific effluvia, have been obliged to have recourſe to the ſame two muſcles; but then they only make them reſervoirs of the corpuſcles by which the numbneſs is effected. Lorenzini, who has obſerved the contraction, as well as Reaumur, pretends, all its uſe is to expreſs thoſe corpuſcles from out of the hollow fibres of thoſe muſcles wherein they are impriſoned; but this emanation of corpuſcles, admitted by moſt authors, is diſapproved by Mr. Reaumur, from the following conſiderations.

1. Becauſe no numbneſs is conveyed, if the hand be at the ſmalleſt diſtance from the torpedo: now, to uſe their own compariſon, if the torpedo numbs as the fire warms, the hands would be affected at a diſtance from the one, as well as the other.

2. Becauſe the numbneſs is not felt till the contraction of the muſcles is over; whereas, were the cauſe in torporific particles expreſſed by the contraction, the effect would be felt in the time of contraction.

3. Becauſe, were the numbneſs the effect of torporific particles, it would be conveyed by degrees, as the hand warms by degrees.

Laſtly, becauſe the torpedo conveys its numbneſs to the hand through a hard ſolid body, but does not do it through the air. Were the only uſe the torpedo makes of its faculty the ſaving itſelf from the fiſhermen, as ſome have ſuppoſed, it would ſignify but little; for it is very rare that it eſcapes their hands. Pliny, Ariſtotle, and moſt naturaliſts, therefore, agree, that it likewiſe ſerves it for the catching other fiſhes, and that it is generally found on banks of ſand, &c. probably to ſerve it as a foundation, or ſupport, for the exerting its faculty. M. Reaumur had no fiſhes alive, to ſee what the torpedo would do to them; but an animal, next a-kin to a fiſh, he tried it on, viz. a drake, which being ſhut up a while in water with the fiſh, was taken out dead; doubtleſs, from its too frequent contacts on the torpedo.

M. Du Hamel, in his Hiſtory of the Academy of Sciences anno 1677, mentions a kind of torpedo's, which he compares to conger eels. M. Richer, from whom he has the account, affirms, on his knowledge, that they numb the arm ſtrongly, when touched with a ſtaff, and

that their effects even produce vertigo's. See (plate CXXXI. *fig.* 3.)

TORQUE, in heraldry, denotes a round roll of cloth, twiſted and ſtuffed: ſuch as the bandage, frequently ſeen in armories, about the heads of Moors, &c. It is always of the two principal colours of the coat; and is accounted the leaſt honourable decoration worn on the helmet, by way of creſt.

TORREFACTION, in chemiſtry, is the roaſting or ſcorching of a body by the fire, in order to diſcharge a part either unneceſſary or hurtful in another operation; as ſulphur is thus diſcharged from an ore, before the metal can be obtained to advantage.

TORRENT, *Torrens*, in geography, denotes a temporary ſtream of water, falling ſuddenly from mountains, whereon there have been great rains, or an extraordinary thaw of ſnow.

TORRICELLIAN, a term very frequent among phyſical writers, uſed in the phraſes, Torricellian tube and Torricellian experiment, on account of the inventor, Torricelli, a diſciple of the great Galileo.

TORRID ZONE, among geographers denotes the tract of earth lying under the line, and extending on each ſide to the two tropics, or to 23 degrees and a half of latitude.

The ancients believed the torrid zone uninhabitable; but from the late navigations we learn, that the exceſſive heat of the day there is tempered by the coldneſs of the night.

TORT, in law, a French term ſignifying wrong or injury.

TORTOISE-SHELL, the ſhell, or rather, ſcales of a teſtaceous animal, called a tortoiſe; uſed in inlaying, and in various other works, as for ſnuff-boxes, combs, &c.

The beſt tortoiſe ſhell is thick, clear, tranſparent, of the colour of antimony, ſprinkled with brown and white: when uſed in marquetry, &c. the workmen give it what colour they pleaſe, by means of coloured leaves which they put underneath it. See the article TESTUDO.

TORTURE, a grievous pain inflicted on a criminal, or perſon accuſed, to make him confeſs the truth.

TOTTED. A good debt to the king is, by the foreign oppoſer, or other officer of the exchequer, noted for ſuch by writing the word *tot*, *q. d. tot pecuniæ regi debentur*; whence it is ſaid to be totted. Alſo that which is paid is to be totted.

TOUCAN, in ornithology, a ſpecies of ramphaſtos, of a middle ſize between our common magpie and the thruſh, but having a beak thicker and longer than its whole body: this beak is hooked at the end, and is of a very thin ſubſtance, not exceeding the thickneſs of a membrane, and very light and hollow, yet bony in ſubſtance, and very bright and ſhining. It has a ſort of toothed edge, which prevents its ſhutting cloſely, and, giving paſſage for the air, enables the bird to live without noſtrils. It is yellowiſh on the outſide and red within, and is covered with a ſort of ſcaly ſubſtance, eaſily ſcraped off with a finger at the edge.

The head of this bird is large in proportion to its body, and is black on the crown; the reſt of it, and the neck and back, are ſlightly variegated with white; its breaſt is of a bright orange colour, its belly and thighs of a very fine and bright red, and the tail is black but red at the end.

TOUCAN, in aſtronomy, a conſtellation of the ſouthern hemiſphere, conſiſting of eight ſmall ſtars, and otherwiſe called Anſer Americanus.

TOUCH-HOLE, or vent in gunnery, is the ſmall hole at the end of the cylinder of a gun or muſquet, by which the fire is conveyed to the powder in the chamber. In a firelock, carabine or piſtol, it is called the touch-hole, but in a piece of cannon it is more properly called the vent.

TOUCH-NEEDLES, ſmall maſſes of gold, ſilver, and copper, each pure and ſimple, and, in all the different combinations, proportions, and degrees of mixture, prepared for the trying gold and ſilver by the touch-ſtone, by compariſon with the mark they leave on it.

The metals uſually tried by the touch-ſtone, are gold, ſilver and copper, either pure, or mixed with one another in different degrees, and proportions, by fuſion. In order to find out the purity, or quantity of baſer metal in theſe various admixtures, when they are to be examined; they are compared with theſe needles, which are mixed in a known proportion, and prepared for this uſe. The metals of theſe needles, both pure and mixed, are all made into laminæ or plates one twelfth of an inch broad, and of a fourth part of their breadth in thickneſs, and an inch and half long; theſe being thus prepared, you are to engrave on each a mark indicating its purity, or the nature and quantity of the admixture in it.

The manner of making the touch-needles is by the proportions of the mark, a weight of half a pound, or eight ounces, being divided into ſixteen half ounces, the half ounces each into four drachms, the drachm into four penny-weights, and this into two half penny-weights.

Silver TOUCH-NEEDLES, theſe muſt be only tempered with copper, and the proportion determined by the mark divided into half ounces and grains.

You muſt uſe therefore for this purpoſe, one mark of ſuch a weight that it may conſtitute a ſufficient maſs of metal for the making one needle, let it weigh for inſtance one drachm, then weigh ſuch a mark of the pureſt ſilver, wrap it up in a ſmall paper, and upon this write ſixteen half ounces, which will ſignify that the whole mark of this metal is the pureſt ſilver; make the firſt needle of this maſs.

Next weigh fifteen half ounces of pure ſilver, and one half ounce of pure copper; wrap theſe both in a paper, and write on it fifteen half ounces, which will ſignify that there are in that ſmall maſs fifteen parts of pure ſilver, and one part of pure copper: make of this the ſecond needle. In the ſame manner go on with the reſt, add two half ounces of copper to fourteen half ounces of ſilver, mark it fourteen half ounces, make the third needle of this, and in the ſame manner proportion the ſmall maſſes of ſilver and copper for making the other needles, and put inſcriptions upon every one in the following manner:

For the needle		half oz. of ſilver		half oz. of copper.
	1.—16		0	
	2.—15		1	
	3.—14		2	
	4.—13		3	
	5.—12		4	
	6.—11		5	
	7.—10		6	
	8.— 9		7	
	9.— 8		8	
	10.— 7		9	
	11.— 6		10	
	12.— 5		11	
	13.— 4		12	
	14.— 3		13	
	15.— 2		14	
	16.— 1		15	

When you have gone thus far, and have the metals in each of theſe proportions, wrapped up in its ſeparate paper; put each ſeparately into a new crucible never uſed for any operation, and adding a little borax melt them together in a very quick fire, which muſt be well kindled before with bellows; or what is yet better, throw them ſuddenly into a hot crucible, and, as ſoon as they melt, ſtir them with a dry wooden peg, burnt at the end, and pour them immediately into an ingot.

When this is done, wrap up each maſs, when cold, in its own paper again, and weigh them ſingly, in a nice balance. If they ſtill weigh a whole mark they are good; but, if there is any conſiderable deficiency in their weight, it is a ſign that your fire having been of too weak, or of too long duration has conſumed as much copper as is wanting in the weight: therefore this maſs muſt be eſteemed uſeleſs, and another made in its place in the ſame proportion.

When this is all finiſhed, make with a hammer, out of each of theſe ſmall maſſes, a needle, heating them a little; then engrave on each of theſe needles, the number of half ounces it contains, as before marked on its paper;

paper; that is, upon the firſt 16, upon the ſecond 15, and ſo on, and then pierce them at one end, and, running a ſilver wire through their eyes, collect them in order according to their different numbers. Theſe are the ſilver touch-needles, made of the different allays of ſilver and copper.

In Holland they make uſe of the mint mark, divided into grains, for the making their needles The firſt needle made of pure ſilver is ſaid to be of twelve penny-weights. The ſecond is made of eleven penny-weights and eighteen grains, by the addition of ſix grains of copper. The third is made of eleven penny-weights and twelve grains, by the addition of twelve grains of copper; and ſo on, the proportion of ſilver decreaſing always ſix grains, that is, one quarter of a penny-weight at a time, and that of the copper being always increaſed in the ſame proportion, till at laſt the weight of the ſilver is reduced to one penny-weight, and that of the copper increaſed to eleven penny-weights, which proportion conſtitutes the laſt needle.

It is needleſs, however, to go through the whole ſeries of the needles, by ſo ſmall progreſſions to the very laſt, for very delicate proportions cannot be very accurately diſtinguiſhed in the operation.

Gold TOUCH-NEEDLES. Theſe muſt be mixed either with ſilver alone, or with ſilver and copper, variouſly intermixed. This mixture is called allaying or carracting, and is determined with a mark divided into carracts or weights of two ſixth parts of an ounce. There is nothing to be obſerved about the making of theſe needles, beſides what has been already ſaid in regard to the ſilver needles; except that the proportions of the weights are determined in another manner. Theſe needles are made according to the following diviſion and order; and they all weigh one mark.

The firſt is entirely of pure gold.

2. 23 Car. 6 Gr.	pure gold	6 Gr.	pure ſilver.	
3. 23 Car.		1 Car.		
4. 22 Car. 6 Gr.		1 Car. 6 Gr.		
5. 22 Car.		2 Car.		
6. 21 Car. 6 Gr.		2 Car. 6 Gr.		
7. 21 Car.		3 Car.		
8. 20 Car. 6 Gr.		3 Car. 6 Gr.		
9. 20 Car.		4 Car.		
10. 19 Car.		5 Car.		
11. 18 Car.		6 Car.		

The decreaſe goes on thus, by whole carracts, till the weight of the gold is arrived at one carract, and that of the ſilver at twenty-three; for after the ninth needle you cannot make ſo exact a diſtinction of the half carracts.

This mixture of gold and ſilver is called the white allay; but, when copper together with ſilver enters into the mixture of the gold, then it is called a mixed allay. The needles, for trial of pieces thus debaſed, are made of mixtures analogous to the former, except only that thoſe portions which in the firſt caſe were pure ſilver, here conſiſt of copper and ſilver mixed. Therefore you have a double ſeries; for the mixture is either of two parts of ſilver, and one of copper, or of two parts of copper, and one of ſilver. For inſtance,

The firſt is of pure gold.

2.	of pure gold.	23 Car. 6 Gr.	of pure ſilver.	4 Car.	of pure copper.	2 G.
3.		23 Car.		8 Gr.		4 G.
4.		22 Car. 6 Gr.		1 Car.		6 G.
5.		22 Car.		1 Car. 4 Gr.		8 G.
6.		21 Car. 6 Gr.		1 Car. 8 Gr.		10 Gr.
7.		21 Car.		2 Car.		1 Car.
8.		20 Car. 6 Gr.		2 Car. 4 Gr.		1C. 2G.

and ſo on as in the foregoing.

If in this table you take pure copper inſtead of pure ſilver, and ſilver inſtead of copper, this gives you a third ſeries of golden needles. And you may have a fourth by mixing with gold equal quantities of ſilver and copper in the ſame proportion. Theſe allays of gold are much in uſe, but workmen may eaſily employ a multitude of other variations, which, compared with the already mentioned, will be diſtinguiſhed in a thouſand different ways by an experienced perſon, ſo that it is neither poſſible, nor neceſſary, to imitate them all.

But that theſe golden needles may not be too expenſive, they may be made much ſhorter than thoſe of ſilver, and afterwards ſoldered to plates of copper, that may be ſufficiently long for uſe.

The uſe of theſe needles is by means of the touch-ſtone; and ariſes hence, that every metal when pure muſt have its ſpecific colour, that diſtinguiſhes it from the reſt: but, metals being the moſt opake of all known bodies, the ſpecific colour of every one appears moſt diſtinctly, when you rub it againſt a very black hard ſtone; and if the colours of two or more metals are expreſſed by large lively ſpots, made near each other on the ſame plane, by rubbing them againſt the ſurface of the ſtone, you will by that means eaſily diſcern their difference, or their likeneſs.

The ſtone adapted to this uſe, and called from its office the touch-ſtone, muſt have the following qualities. It muſt be of the deepeſt black, leſt the tincture of the metal ſhould be altered by ſpurious rays of light ſhining among it: it muſt be capable of being pretty well poliſhed, for, when too rough, the colours of the metals rubbed againſt it cannot be neatly or regularly diſtinguiſhed; and, if it is too ſmooth, the metals are but faintly, and too ſlowly abraded or ſcraped by it, eſpecially when gold is tried. It muſt alſo be neither too hard, nor too ſoft. Tripoli, coal-duſt, and tin-aſhes are uſed in rubbing off the thin metalline cruſts, and in a ſhort time the ſtone, when very hard, is apt to acquire too ſmooth a ſurface; and, when it is too ſoft, it eaſily wears, throws off a duſt, and contracts furrows.

The black rough marbles, and the ſofter black pebbles from the beds of rivers, are moſt proper for this uſe, and are to be made into the form of a quadrangular priſm, about an inch thick, and two or three inches long.

The method of uſing your needles and the ſtone is this: when you meet with a piece of metal to be tried, firſt wipe it very well with a clean towel, or piece of ſoft leather, that you may the better ſee its true colour; for from this alone an experienced perſon will in ſome degree judge before-hand what the principal metal is, and how, and with what debaſed. Then chuſe a convenient not over large part of the ſurface of the metal, and rub it ſeveral times very hardly and ſtrongly againſt the touch-ſtone, that, in caſe a deceitful coat or cruſt ſhould have been laid upon it, it may be worn off by that friction. This however is done more readily by a grind-ſtone or ſmall file, if you have them at hand. Then wipe a flat and very clean part of the touch-ſtone, and rub againſt it, over and over, the juſt mentioned part of the ſurface of the piece of metal, till you have on the flat ſurface of the ſtone a thin metallic cruſt, an inch long and about an eighth of an inch broad: this done, look out the needle that ſeems moſt like to the metal under trial, wipe the lower part of this needle very clean, and then rub it againſt the touch-ſtone as you did the metal by the ſide of the other line, and in a direction parallel to it. When this is done, if you find no difference between the colours of the two marks, made by your needle, and the metal under trial; you may with great probability pronounce that metal, and your needle, to be of the ſame allay; which is immediately known by the mark engraved on your needle. But, if you find a difference between the colour of the mark given by the metal, and that by the needle you have tried; chuſe out another needle, either of a darker or a lighter colour than the former, as the difference of the tinge on the touch-ſtone directs; and by one or more trials of this kind you will be able to determine which of your needles the metal anſwers, and thence what allay it is of, by the mark of the needle; or elſe you will find that the allay is extraordinary, and not to be determined by the compariſon of your needles.

But, if the metal under trial has been altered by tin, arſenic, zink, or other ſuch admixtures, the workmen may be deceived by the colour, ſo as to take for pure gold, or ſilver, that which is not by any means ſuch. Deceits of this kind, however, are found out by the aſſiſtance of acid menſtrua. Aqua fortis anſwers this purpoſe, when the maſs is of the colour of gold, and aqua-

PLATE CXXXI.

Trepanning Instruments.

Fig. 1. Tongue.

Fig. 2.

Fig. 3. Torpedo.

Fig. 4.

Fig. 5. Tournequets.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Tournequets.

Traverse.

aqua-regia, when it is of the colour of ſilver; for the firſt of theſe menſtrua diſſolves all metals except gold, and the latter all metals except ſilver. In this caſe then you are to pour, upon your metallic ſtreak on the ſtone, one ſmall drop of either of theſe liquors, and extend it gently over it with a feather. If it is neither gold nor ſilver, the whole ſtreak will be obliterated and conſumed; but, if there is any gold or ſilver in it, this remains undiſſolved, and ſhews another colour, becauſe the other parts have been ſeparated from it by the ſolution. When theſe menſtrua are uſed, great care muſt be taken that there is no oil in the way; for that would ſpoil and deſtroy their effects.

Beſides theſe, the following particulars are to be obſerved: gold and ſilver when pure, whether ſeparate or both mixed together, without the addition of any other matter, when made hot in the fire, not only preſerve their colour, but, if they were tarniſhed before, they recover their ſplendor there, not loſing the leaſt part of their weight: and, by this quality in theſe two metals, the caratura alba, or white allay, made by the mixture of gold and ſilver alone, is diſtinguiſhed from all the others. If you have not liberty to try the whole maſs in the fire, you may make this experiment on a ſmall piece of it with a blow-pipe.

If you find a needle of the ſame allay with the metal under trial, the ſtreaks made by both upon the touch-ſtone muſt undergo exactly the ſame changes when aqua-fortis is poured on them; and this ought always to be made a part of the trial by the touch-needles, that no fraud may be at the bottom.

All gold rendered brittle, when compared with the touch-needles by the ſtone, will appear leſs pure than it really is; and on the contrary all ſilver rendered brittle has the whiteneſs of ſilver in a higher degree: nor is there any wonder in this, when rightly conſidered, ſince the bodies which make gold and ſilver brittle are only a few metals, and ſemi-metals, all of a very bright white colour, and neceſſarily adding to the whiteneſs of ſilver, and taking from the yellowneſs of gold; ſuch are tin, lead, regulus of antimony, biſmuth, zink, and arſenic. Theſe dilute the yellow colour of gold or copper into a whiteneſs, ſo that the colour of copper mixed with the ſilver is hidden by admixtures of this kind, whereas gold on the contrary appears by them to have much more ſilver in it than it really has.

In a white allay, aqua-fortis does not diſcover the preſence of ſilver from twenty-three to ſeven carats, becauſe aqua-fortis does not ſeparate ſilver from gold, unleſs the maſs contains three times more ſilver than gold.

Metallic ſtreaks or cruſts which have been left ſome time upon the touch-ſtone, cannot be compared with freſh ones, with any degree of uſe, becauſe their remaining long on the ſtone always alters their colour.

Silver when tempered with braſs appears whiter than it would do with a like quantity of copper, and, as it may then be rendered ſufficiently ductile by a proper operation, you will hardly be able to find out the fraud with the touch-ſtone, unleſs you make a ſecond time the ſame compariſon with the ſtreak of a needle of the ſame colour, having previouſly poured aqua-regia upon the metallic cruſt laid by rubbing on the touch-ſtone; nor are touch-needles, tempered with braſs, of any great uſe on this occaſion, ſince this artificial metal is ſometimes more and ſometimes leſs yellow.

TOUCH-STONE, a black, ſmooth, gloſſy ſtone uſed to try metals upon.

The ancients called it *lapis Lydius*, the Lydian ſtone, from Lydia, a country of Aſia Minor, whence it was brought.

The moderns call it touch-ſtone, in regard the proof they make of metals, chiefly ſilver, is, by touching or rubbing the metal to be tried on the ſtone, and comparing the colour of the mark it leaves thereon, with the mark of another piece of metal of the ſame ſpecies, whoſe goodneſs is paſt doubt.

The Iriſh touch-ſtone, called baſſanus Hibernicus by Molyneux, and ſome others, is a black marble found in the county of Antrim in that kingdom, in angular columns, forming that amazing pile called by the vulgar the Giant's Cauſeway.

This marble has the property of trying metals by the touch beyond any other known ſtone; but it is not eaſily wrought into form, being ſo hard that it turns the edges of all the tools uſed to cut ſtones. Were it not for this, it is admirably calculated for building, and for ornamental works; but nobody has attempted to uſe it in this manner, any where, except in the church of Ballywellan in the neighbourhood; and here the trouble of cutting is avoided, for the joints are taken as they found them, and the church is built of theſe in their natural ſhape, piled one upon another. The outer ſurface of this ſtone is of a whitiſh colour like lime-ſtone, but this is only the effect of the weather upon it; for wherever it is broken it is found to be of a fine iron grey, and when poliſhed appears of a true and deep jetty black.

TOUR, a French term, frequently uſed for a journey or progreſs through one or more countries.

TOURNAMENT, or TURNAMENT. See TURNAMENT.

TOURNEFORTIA, in botany, a genus of plants; the empalement of the flower is permanent, of one leaf, cut into five ſmall ſegments at the top. The flower is of one petal, of the globular bell ſhape, cut at the brim into five acute points, which ſpread openly horizontally; it has five awl-ſhaped ſtamina the length of the tube, terminated by ſingle ſummits, and a globoſe germen ſupporting a ſingle ſtyle the length of the ſtamina, crowned by a ſingle ſtigma. The germen afterward becomes a ſpherical ſucculent berry, incloſing four oblong oval ſeeds, reſting upon the empalement.

Mr. Miller enumerates eight ſorts of this plant, natives both of the Weſt Indies, and of New Spain; and may be all propagated by ſeeds or cuttings. If by ſeeds, they muſt be procured from the countries where they grow naturally; theſe ſhould be ſown in ſmall pots filled with light earth, and plunged into a hot-bed of tanners bark. Theſe ſeeds ſometimes grow the firſt year, but they often remain in the ground a whole year; therefore, if the plants ſhould not come up the ſame ſeaſon, the pots ſhould be plunged in autumn into the tan-bed in the ſtove, where they ſhould remain all the winter; and in the ſpring they ſhould be removed out, and plunged into a freſh tan-bed, which will ſoon bring up the plants, if the ſeeds were good. When theſe are fit to remove, they ſhould be each planted in a ſmall pot, and plunged into a tan-bed, where they muſt be ſhaded from the ſun till they have taken new root; and then they muſt be treated in the ſame way as other tender plants from the ſame countries, which require to be kept in the bark ſtove. The plants raiſed from cuttings muſt be treated in the ſame way.

TOURNEQUET, in ſurgery, an inſtrument made of rollers, compreſſes, ſcrews, &c. for compreſſing any wounded part, ſo as to ſtop hæmorrhages.

The common tournequet is very ſimple, conſiſting only of a roller, which, with the help of a ſmall ſtick, ſerves to ſtop the effuſion of blood from large arteries, in amputations, by forcibly tying up the limb. The things neceſſary for this are a roller, of a thumb's breadth, and of an ell in length, a ſmall cylindrical ſtick, a conglomerated bandage, two fingers thick and four long, ſome compreſſes of a good length and about three or four fingers breadth, to ſurround the legs and arms, and a ſquare piece of ſtrong paper or leather, about four fingers wide. See plate CXXXI. *fig.* 4.

The manner of applying this inſtrument is thus; the rolled bandage is to be applied to the trunk of the wounded artery length ways, covering it, in a contrary direction, with compreſſes ſurrounding the foot, leg or arm, as it were with a ring; the roller muſt be paſſed twice round theſe applications and faſtened in a knot, but ſo looſely that you may eaſily introduce your hand between it and the part: the leather or thick paper muſt now be nicely placed under it, upon the external part of the leg, and the roller tightened by degrees, by turning round the ſtick, which is to be introduced into the knot; this to be done till the hæmorrhage is entirely ſtopped: the ſtick muſt now be kept in this ſituation till the wound is properly treated, and the return of the hæmorrhage is prevented.

When this end is acquired, the tournequet is to be looſened, or entirely taken off, as ſhall be judged moſt convenient; but where it is applied to the arm, the rolled bandage is to be placed near the axilla, in the internal part of the humerus, and the ſtick in this caſe is to be faſtened on the oppoſite ſide, the ſituation of the artery there requiring this poſition: and when it is to be applied to the thighs, the bandage is to be put as the caſe ſhall require, either to the upper part of the thigh, or juſt over the knee.

But beſides the common tournequet, there are other more complex forms of this inſtrument. *Fig.* 5. is a braſs tournequet, for ſtopping the hæmorrhages in wounds of large arteries: where A A is a braſs plate, ſomewhat bent; B B, a ſtrong braſs ſcrew; C, a round plate, to be fixed upon the wound; D, the button which turns the ſcrew; E E, a ſtrong leather belt, to ſurround the wounded part; F F, part of the belt pierced with holes, whereby it may be fixed upon the belt G G, and lengthened and ſhortened according to the ſize of the limb.

Fig. 6. is another braſs tournequet, after Petit's manner, the uſe and application of which will be eaſily underſtood from the deſcription of *fig.* 5.

In *fig.* 7. is delineated a wooden tournequet, where A A is the upper part; B B, the lower part; C, the ſcrew; D, the two ſmall iron ſcrews, to which a leather or ſilk belt is to be fixed; E, hooks, on which to faſten the other end of the belt; F F, the ends of the upper and lower parts of the inſtrument, hollowed to receive the belt, and keep it ſteady in its ſituation.

Fig. 8. Is another kind of tournequet, made of iron, the parts and uſes of which will be eaſily conceived from what has been already ſaid.

TOWAGE, the hawling or drawing of a ſhip, barge, &c. by men or beaſts, or by another ſhip or boat, faſtened to her, in order to make her enter a port, aſcend a river, &c.

TOWER, *Turris*, a tall building, conſiſting of ſeveral ſtories, uſually of a round form, though ſometimes ſquare or polygonal.

Towers are built for fortreſſes, priſons, &c. as the Tower of London, the Tower of the Baſtile, &c.

The Tower of London is not only a citadel, to defend and command the city, river, &c. but alſo a royal palace, where our kings, with their courts, have ſometimes lodged; a royal arſenal, wherein are arms and ammunition for ſixty thouſand ſoldiers; a treaſury for the jewls and ornaments of the crown; a mint for coining of money; the great archive, wherein are preſerved all the antient records of the courts of Weſtminſter, &c. and the chief priſon for ſtate criminals.

TOWN, a place inhabited by a conſiderable number of people, being of a middle ſize between a city and village.

TOXICODENDRON, Poiſon-tree, in botany, a tree the male flowers of which are upon different plants from the female; they have a ſmall empalement, cut into five points at the brim, but have no petals; they have five ſhort ſtamina, terminated by roundiſh ſummits. The female flowers have empalements like the male; they have no ſtamina, but in the center is ſituated a roundiſh germen, ſupporting three ſmall ſtyles, crowned with globular ſtigmas. The germen afterwards turns to a berry with one or two cells, incloſing one ſeed in each.

Mr. Miller enumerates nine ſpecies of the poiſon-tree, all poſſeſſed of the ſame poiſonous quality.

The firſt ſort grows naturally in moſt parts of North-America; it has a low ſhrubby ſtalk, which ſeldom riſes more than three or four feet high, ſending out ſhoots near the bottom, which trail upon the ground, putting out roots from their joints, whereby it multiplies and ſpreads greatly; ſo that when it is not confined, or trained up to a ſupport, the ſtalks ſeldom riſe upward. If the ſtalks happen to be cloſe to a wall, they emit roots which faſten to the joints in the wall, and ſupport themſelves when they are ſevered from the root; and the ſtalks of ſuch plants will become more ligneous, and riſe much higher, than thoſe which grow in the ground. The foot-ſtalks of the leaves are near a foot long; the leaves are compoſed of three ſmooth, oval heart ſhaped lobes, which are entire. The flowers come out from the ſide of the ſtalk in looſe panicles, of an herbaceous colour, and ſmall, ſo make no great appearance. Some plants have only male flowers with five ſtamina in each; theſe decay without producing fruit; but upon other plants they are only female flowers, which have a germen and three very ſhort ſtyles; theſe are ſucceeded by roundiſh, channelled, ſmooth berries, of a yellowiſh grey colour, which incloſe one or two ſeeds.

This plant, when once planted in a garden, will propagate faſt enough by its trailing branches, which put out roots at every part. It will thrive in almoſt any ſoil or ſituation.

The ſecond ſort grows naturally in moſt parts of North America. The ſtalks of this riſe higher than thoſe of the former; the branches are ſlender, but ligneous; they have a brown bark, and are garniſhed with downy leaves, ſtanding upon pretty long foot-ſtalks, compoſed of three oval lobes, indented angularly, and hoary on their under ſide. The male flowers, which are produced on ſeparate plants from the fruit, come out from the ſide of the ſtalks in cloſe ſhort ſpikes; theſe are of an herbaceous colour, and have five ſhort ſtamina in each. The female flowers are produced in looſe panicles; theſe are in ſhape and colour like the male, but larger, and have a roundiſh germen, ſupporting three very ſhort ſtyles, and are ſucceeded by roundiſh berries, which ripen in autumn.

The third ſort grows naturally in North America; this has a ſhrubby, erect, branching ſtalk, which riſes ſix or ſeven feet high, covered with a brown bark, garniſhed with ſmooth triſoliate leaves, whoſe lobes are oval, ſpear-ſhaped, and have a few ſinuated indentures on their borders. The male and female flowers grow upon ſeparate plants; their ſhape and colour like thoſe of the former, and the fruit is alſo like that.

The fourth ſort grows naturally in Virginia, Penſylvania, New England, and Carolina; from all theſe countries I have received ſeeds: it alſo grows in Japan. This, in the countries where it grows naturally, riſes with a ſtrong woody ſtalk to the height of twenty feet or upward; but in England we ſeldom ſee any of them more than five or ſix; the reaſon of this is from the plants being tender, ſo are deſtroyed in ſevere winters; but I have ſeen ſome plants, which were kept in pots and ſheltered in winter, upward of ten feet high, in the garden of Samuel Reynardſon, Eſq^{r}; at Hillendon, which, after his death, were purchaſed with all his other exotic plants by Sir Robert Walpole. This has a ſtrong woody ſtalk, covered with a light brown bark, inclining to grey. The branches are garniſhed with winged leaves, compoſed of three or four pair of lobes, terminated by an odd one. The lobes vary greatly in their ſhape, but for the moſt part they are oval and ſpear-ſhaped; they are ſometimes rounded at their baſe, but generally end in acute points; their upper ſurface is ſmooth, of a lucid green, but their under ſide is pale, and a little hairy. The foot-ſtalks of the leaves change to a bright purple colour toward the latter part of the ſummer, and in autumn all the leaves are of a beautiful purple colour before they fall off. The male flowers are produced upon looſe panicles from the wings of the branches; they are ſmall, of an herbaceous white colour, compoſed of five ſmall roundiſh petals, and have five ſhort ſtamina within, terminated by roundiſh ſummits. The female flowers are upon ſeparate plants from the male, and are diſpoſed on looſe panicles; theſe are ſhaped like the male, but are ſomewhat larger, and have in their center a roundiſh germen, ſupporting three very ſhort ſtyles, crowned with globular ſtigmas. The germen afterward turns to a berry, variable in ſhape, ſometimes almoſt oval, at others ſhaped like a ſmall ſpear; but the moſt general form is roundiſh, with a protuberance almoſt like the cicer; theſe include one ſeed. It flowers in July, and in warm ſeaſons the female plants produce fruit, but they ſeldom ripen here.

This is undoubtedly the ſame plant which is mentioned by Dr. Kempfer in his *Amœnitates Exoticarum*, by the title of *Sitz vel Sitz Adju*, or *Arbor vernicifera legitima, folio pinnato juglandis, fructu racemoſa Ciceris facie. Faſc. v. p.* 791, 792. The true varniſh tree, with a walnut tree leaf, and a branching fruit like cicers. But the figure

gure he has exhibited of it, is the moſt inaccurate of any perhaps to be found in any of the modern books of botany. It is drawn from a ſide ſhoot of a branch which has been cut off, ſo has neither flower or fruit to it, and being a vigorous ſhoot, the leaves are very different in ſize and ſhape from thoſe on plants which have not been headed; and his deſcription of the leaves ſeems to have been taken from this branch, otherwiſe he could not have compared them to thoſe of the walnut-tree. He ſeems to have been conſcious of this fault, by his adding another figure of the plant in ſmall under his own; taken from a Japan herbal, in which there is a much better repreſentation of it than his own conveys. How a perſon who was employing himſelf in making drawings of plants in a country, where the natural hiſtory of it was ſo little known, ſhould make choice of ſuch an imperfect ſample for his figure, is amazing, for there can be no doubt of his meeting with perfect plants in flower or in fruit, in a place where the ſhrubs are cultivated ſo plentifully as he mentions; and in his deſcription of it, he ſets out by comparing the height of the ſhrubs to thoſe of willow, than which he could not have choſen any plant by way of compariſon, which would have conveyed a more indetermined idea; for it is well known there are different ſpecies of willow, whoſe growth is from four to forty feet high; therefore there can be no other way of reconciling his deſcription with what he afterward mentions, unleſs when he is giving an account of the method uſed by the natives in collecting the varniſh; where he ſays the ſhrubs are cut down every third year, but by comparing their growth with that of the willows, which are cut down for fuel, &c. every four or five years.

However, as the dried ſamples of the plant which he brought over, agree with the American Toxicodendron, and the milky juice of both have the ſame qualities of ſtaining, ſo there can be no doubt of the plants being the ſame; therefore if it is thought that varniſh may be of public utility, it may be collected in plenty in moſt of the Engliſh ſettlements in North America.

Kempfer has alſo given a figure and deſcription of a ſpurious varniſh tree, which is called Faſi-no-Ki by the natives, and is by him titled, *Arbor vernicifera ſpuria, Sylveſtris anguſti-folia*; ſpurious wild varniſh-tree with a narrow leaf, which he ſays agrees with the other in every part, excepting the lobes of the leaves, which are narrower. This led me into a miſtake in the former editions of the Gardener's Dictionary, by ſuppoſing their difference might ariſe from culture only; but having ſince raiſed from ſeeds a ſhrub which has all the appearance of his ſpurious varniſh-tree, and is evidently a diſtinct ſpecies, if not of a different genus from the true ſort, I am certain Kempfer has been guilty of a great miſtake in this particular. The ſeeds of this were ſent from China, for thoſe of the varniſh-tree; but when I ſowed them, I remarked they were pretty much ſhaped like thoſe of the beech-tree, but ſmaller; being thick on one ſide and ſlender on the other, in ſhape of a wedge, from whence I ſuppoſed there were three of the ſeeds included in one capſule. There is a ſhrub of this kind now growing in the Chelſea garden, which is more than fifteen feet high; but, as it has not yet produced flowers, I am at a loſs where to range it.

The fifth ſort grows naturally in North America, from whence the ſeeds were a few years ſince brought to England. This has a ſhrubby ſtalk, which ſends out many ligneous branches, covered with a ſmooth purple bark, garniſhed with ſmooth trifoliate leaves, ſtanding upon foot ſtalks an inch long; the lobes are oval, of a deep lucid green on their upper ſide, but of a pale green on their under, deeply crenated or indented on their edges, their baſe joining cloſe to the foot-ſtalks. The leaves, when bruiſed, emit an odour like that of orange peel, from whence the gardeners have titled it the ſweet-ſcented toxicodendron. The male flowers are produced in ſhort cloſe panicles; they are ſmall, of an herbaceous white colour; they are upon ſeparate plants from the fruit, which grow in ſparſed panicles, and are of an oval ſhape.

The ſixth ſort grows naturally in North America. The ſtalks of this ſort emit roots their whole length, whereby they faſten to trees or any neighbouring ſupport, and climb to the height of ſix or eight feet, garniſhed with trifoliate oval leaves, which are ſmooth, and cut into ſinuſes on their edges. The flowers are produced in ſhort panicles from the ſide of the branches; they are male and female on different plants like the other ſpecies.

The ſeventh ſort was ſent me by Mr. John Bartram from Philadelphia, by the title of great toxicodendron; this hath trailing roots, which run near the ſurface of the ground, ſending up ſtalks in different places; the leaves ſtand upon long foot-ſtalks, compoſed of three or four obtuſe rough lobes, ſawed on their edges.

The firſt, ſixth, and ſeventh ſorts propagate in plenty by their creeping ſtalks and roots; the others are propagated by laying down their branches, which will put out roots in one year, and may then be taken off and tranſplanted, either in the places where they are to remain, or in a nurſery to grow two or three years, to get ſtrength before they are planted out for good; they may alſo be propagated by ſeeds, which ſhould be ſown on a bed of light earth, and when the plants come up, they muſt be kept clean from weeds the following ſummer; and before the froſt comes on in autumn, the bed ſhould be hooped over, that the plants may be covered with mats, for otherwiſe the early froſts will kill their tops, which frequently cauſes their ſtalks to decay to the ground; for as the young plants are tender, and generally ſhoot late the firſt year, they are in much greater danger than when they get more ſtrength. In ſpring the plants may be tranſplanted into nurſery-beds to grow a year or two, and may then be tranſplanted for good.

Theſe plants are preſerved by the curious in botany, for the ſake of variety; but as there is little beauty in them, there are not many of the ſorts cultivated in England. The wood of theſe trees, when burnt, emits a noxious fume, which will ſuffocate animals when they are ſhut up in a room where it is burnt: an inſtance of this is mentioned in the Philoſophical Tranſactions by Dr. William Sherard, which was communicated to him in a letter from New England by Mr. More, in which he mentions ſome people who had cut ſome of this wood for fuel, which they were burning, and in a ſhort time they loſt the uſe of their limbs, and became ſtupid; ſo that if a neighbour had not accidentally opened the door, and ſeen them in that condition, it is generally believed they would ſoon have periſhed. This ſhould caution people from making uſe of this wood for ſuch purpoſe.

When a perſon is poiſoned by handling this wood, in a few hours he feels an itching pain, which provokes a ſcratching, which is followed by an inflammation and ſwelling. Sometimes a perſon has had his legs poiſoned, which have run with water. Some of the inhabitants of America affirm, they can diſtinguiſh this wood by the touch in the dark, from its extreme coldneſs, which is like ice; but what is mentioned of this poiſonous quality, is moſt applicable to the fourth ſort here mentioned, which, by the deſcription, agrees with this ſpecies.

The juice of the tree is milky, when it firſt iſſues out of the wounded part; but ſoon after it is expoſed to the air, it turns black, and has a very ſtrong fœtid ſcent, and is corroding; for I have obſerved, on cutting off a ſmall branch from one of theſe ſhrubs, that the blade of the knife has been changed black in a moment's time, ſo far as the juice had ſpread over it, which I could not get off without grinding the knife.

The eighth ſort grows naturally in Jamaica on the red hills, and at Campeachy in great plenty. It has a thick woody ſtem, which riſes near thirty feet high, with a ſmooth aſh-coloured bark, ſending out ligneous branches on every ſide, which have a hairy ruſty-coloured bark, garniſhed with trifoliate leaves, which have hairy foot-ſtalks. The lobes are ſpear-ſhaped, unequally ſawed towards the top, and have many tranſverſe veins running from the midrib to the borders, and have a brown woolly down on their under-ſide. The flowers are ranged in a ſingle racemus, which ſprings from the wings of the branches; they are ſmall, of a yellowiſh colour, and the female flowers are ſucceeded by ſmall oval berries, of an orange colour when ripe.

The ninth ſort grows naturally about Carthagena in New Spain; this riſes with a ſhrubby ſtalk twelve or fourteen feet high, covered with a grey bark, ſending out a great number of branches on every ſide, which are garniſhed with trifoliate ſmooth leaves, whoſe lobes are oval, ſpear-ſhaped, and oblique to their foot-ſtalks. The male and female flowers are upon different plants; they are formed in looſe panicles, are ſmall, and of a dirty white colour. The female flowers are ſucceeded by ſmall, oval, ſmooth berries, each including one ſeed.

The two laſt ſorts are tender plants, ſo will not thrive in this country, without the aſſiſtance of artificial heat; they are propagated by ſeeds, when theſe can be procured from the countries where the plants grow naturally. Theſe ſhould be ſown as ſoon as they arrive here, in pots filled with light earth, and plunged into a tan-bed. Sometimes the plants will come up the ſame year, but the ſeeds often lie long in the ground when they are ſown in the ſpring; and when they do not grow the firſt year, the pots ſhould be plunged in the bark-bed in the ſtove in autumn, where they may remain all the winter; and in the ſpring they ſhould be plunged into a freſh hot-bed under a frame, which will ſoon bring up the plants. When theſe are fit to remove, they ſhould be each planted in a ſmall pot, filled with light earth, and plunged into a new tan-bed, obſerving to ſhade them from the ſun till they have taken new root; then they ſhould be treated in the ſame way as other tender exotic plants, which are conſtantly kept in the bark-ſtove. *Miller's Gard. Dict.*

TOXICUM, a ſort of poiſon, ſaid to be uſed by the Indians to their arrows, in order to render wounds made by them incurable.

TRABEATION, in the ancient architecture, the ſame with entablature. See the article ENTABLATURE.

TRACES *of the Brain*, among the Carteſians, denotes the impreſſions which ſenſible objects make on the fine fibres of the brain, by means of the organs of ſenſe; on which impreſſions memory, imagination, &c. are ſuppoſed, in a great meaſure to depend. See MEMORY, &c.

TRACHEA, in anatomy. See the article ASPERA ARTERIA.

TRACHELIUM, in botany, a genus of plants, with a funnel faſhioned flower, divided into five ſegments at the limb; the fruit is a roundiſh obtuſely trilobous capſule, containing a great number of very minute ſeeds: It is a native of Italy, and grows naturally in ſhady-woods.

This plant is propagated by ſeeds, which ſhould be ſown in autumn ſoon after they are ripe; for when they are kept out of the ground till ſpring, they frequently fail, or if they do grow, it is not before the following ſpring. When the plants come up, they ſhould be kept clean from weeds, and as ſoon as they are big enough to remove, ſhould be tranſplanted on an eaſt aſpected border of light undunged earth, placing them in rows ſix inches apart, and four inches diſtant in the rows, ſhading them from the ſun till they have taken new root; after which they require no other care but to keep them clean from weeds till autumn, when they may be tranſplanted into the borders of the flower-garden, where they will flower the following ſummer.

But as theſe plants thrive better on old walls, when by accident they have ariſen from ſeeds, ſo their ſeeds, when ripe, may be ſcattered on ſuch walls as are old, or where there is earth lodged ſufficient to receive the ſeeds, where the plants will come up and reſiſt the cold much better, and continue longer than when ſown in the full ground; and when a few of the plants are eſtabliſhed on the walls, they will ſhed their ſeeds, ſo that they will maintain themſelves without any farther care. Mr. Miller ſays he has obſerved ſome plants of this kind, which have grown from the joints of a wall, where there has not been the leaſt earth to ſupport them, which have reſiſted the cold, tho' they have been greatly expoſed to the winds, when moſt of thoſe in the full ground were killed; ſo that theſe plants are very proper to cover the walls of ruins, where they will have a very good effect.

TRACHEOTOMY, in ſurgery, the name of an operation otherwiſe called bronchotomy. See the article BRONCHOTOMY.

TRACING, in huſbandry, a term uſed by our planters in the method of preſerving the maize or Indian corn. This, being a large grain, is apt to ſpoil, if not carefully preſerved.

Some threſh out the corn as ſoon as the ears are gathered, and lay it up in holes of the earth, which are their granaries: but thoſe who have not opportunities of doing this, trace it, that is, they leave it in the ear, and weave or faſten together a great number of ears by the ends of the huſks: theſe traces of corn they hang up within doors, on ſuch ſupports as will keep them from one another; and they will, in this manner, keep good the whole winter.

This is a method of our introducing; but their own of burying the clean corn was at leaſt as good, and was the ſame practiſed by the Ægyptians of old, and by all the wiſeſt nations of the Eaſt at this time. But whether we have improved their huſbandry in this particular, or not, it is certain that we have greatly aſſiſted them in the planting this corn, which we do by the plough, inſtead of the troubleſome method they had of doing it with the hoe. The manner of our planting it is this; we plough ſingle furrows the whole length of the field, and at about ſix feet diſtance one from another; we then plough others acroſs at the ſame diſtance, and then, wherever the furrows meet, the corn is thrown in; it is then covered either by the hoe, or by turning another furrow behind it with the plough; and when the weeds begin to overtop the corn, they plough the ſpaces again, and by this means deſtroy and turn in all the weeds, and give the earth ſtirring that greatly aſſiſts vegetation.

TRACT, in geography, an extent of ground, or a portion of the earth's ſurface.

TRACT, in matters of literature, denotes a ſmall treatiſe, or written diſcourſe, upon any ſubject.

TRACTION, the art of drawing, whereby a thing is brought nearer to the mover.

TRACTRIX, in geometry, a curve otherwiſe called catenaria.

TRADE, in general, denotes the ſame with commerce, conſiſting in buying, ſelling, and exchanging of commodities, bills, money, &c.

The firſt notions of trade aroſe from the light of nature. One family no ſooner found that they could not live without the aſſiſtance of another, but they eſtabliſhed a trade by way of barter. As the nations encreaſed, markets were every where eſtabliſhed for the ſame purpoſe, where a ſheep was exchanged for a ſack of corn, or an ox for ſome other neceſſaries of life. This introduced the uſe of weights and meaſures; but trade never became an art, till the invention of ſpinning and weaving, whoſe manufactures introduced a variety of dealing.

Trade, in the next place, regulated the value of all kinds of commodities by a common meaſure or ſtandard, from the inconveniencies of barter, and a certain equivalent, called money, was agreed upon for all ſorts of goods. Formerly, in England, leather money was uſed; and the Africans ſtill uſe cowries, or white ſpeckled ſhells, called black-a-moor's-teeth. But, in proceſs of time, ſilver and gold being found moſt convenient to make money of, they are become the common ſtandard of all commodities; which are purchaſed with more or leſs money, in proportion to the plenty and ſcarcity of the goods brought to market; from hence we date the terms of dearneſs or cheapneſs.

At the introduction of metal money, the merchant adjuſted its value only by weight; but this being found inconvenient, its weight or value was aſcertained by a ſtamp or mark, which is what we call coin. Money not only ſerves commodiouſly to ſettle the price of all goods, but it ſerves to pay for labour, to purchaſe houſes, lands, &c. ſo that from hence ariſes the notion of riches.

This has been the great foundation of commerce; becauſe, as many nations want this depoſitory of wealth, which ſeems to be confined to certain countries; and as

theſe nations, without it, muſt have remained poor, had they not ſome method of acquiring this treaſure; it has cauſed an intercourſe between thoſe nations; ſo that what was called trade, ſo long as confined between people of the ſame country, is properly ſtiled commerce, when it is carried into ſo large an extent.

Commerce could not be eſtabliſhed without ſhipping. At leaſt, thoſe nations who have applied themſelves to that adventurous commerce, have in all ages exceeded thoſe in riches, power, and neceſſaries of life, who enjoyed a better climate, ſoil, or ſituation.

Nothing could be ſo great a ſpur to induſtry, as the invention of trade. When a man knows that his labour ſhall be crowned with plenty, he proceeds with courage, vigour, and activity; he is daily either inventing new ſchemes, or carrying arts, already known, to the utmoſt perfection. In which view, trade is the great principle of ſcience, both theoretical and practical.

Again, it is to trade that we aſcribe the beginning of civility and ſociety: and when this had improved men's circumſtances, the deſire of keeping, and quietly enjoying the property ſo obtained, introduced and eſtabliſhed equal, limited, and legal governments; and living under, and the being protected by ſuch governments, is properly ſtiled liberty; which, therefore, is not only highly conſiſtent with, but, in ſome meaſure, eſſentially neceſſary to trade.

But what has at all times recommended commerce beyond all other acquiſitions, is the power, or ability of independency, which it gives to that nation where it flouriſhes moſt. There is no maxim more inconteſtable in all ages, than that the people who prevail at ſea, will in the end, prevail on ſhore. No maritime power was ever ruined by a land war, till her power was firſt broken at ſea, or ſhe loſt the power of the ſea.

Therefore, if liberty, property, and equal government, a flouriſhing ſtate of learning, perfection in arts and ſciences, public magnificence, private abundance, and a capacity of defending and preſerving theſe bleſſings againſt all invaders, be certain and inconteſtable benefits, they are ſuch as commerce, and ſuch as commerce alone, is able to give to any people or nation.

TRADE-WINDS denote certain regular winds at ſea, blowing either conſtantly the ſame way, or alternately this way and that; thus called from their great uſe in navigation, and the Indian commerce.

The trade winds are of different kinds, ſome blowing three or ſix months of the year one way, and then the like ſpace of time the oppoſite way; very common in the Indian ſeas, and called monſoons.

Others blow conſtantly the ſame way; ſuch is that general wind between the tropics, which, off at ſea, is found to blow all day long from eaſt to weſt.—For the phænomena of each, with their phyſical cauſes, ſee the article WIND.

TRADESCANTIA, in botany, a genus of plants, the flower of which conſiſts of three orbiculated, plane, and very patent petals; and its fruit is an oval trilocular capſule, containing a few angular ſeeds.

This plant is eaſily propagated by ſeeds, which, if they are permitted to ſcatter, will produce plenty of young plants the following ſpring; or if the ſeeds are ſown ſoon after they are ripe, the plants will come up the ſpring after; and when they are fit to remove, they ſhould be planted in a nurſery-bed at about nine inches diſtance, and the ground kept clean from weeds. In autumn they ſhould be removed into the borders of the flower-garden, where they will flower and produce ſeeds, and the roots will continue ſeveral years.

TRADITION, among eccleſiaſtical writers, denotes certain regulations regarding the rites, ceremonies, &c. of religion, which we ſuppoſe to have been handed down from the days of the apoſtles, to the preſent time.

Tradition is diſtinguiſhed into written, of which there are ſome traces in the writings of the ancient fathers; and unwritten, of which no mention is made in the writers of the firſt ages of Chriſtianity.

TRAGACANTH, *Tragacantha*, in botany, a genus of plants; the empalement of the flower is indented in five parts, the lower ſegments being the ſhorteſt. The flower is of the butterfly kind; the ſtandard is long, erect, indented at the point; the borders are reflexed. The wings are ſhorter than the ſtandard. The keel is of the ſame length with the wings, and is indented; it has ten ſtamina, nine are joined and one is ſeparated, terminated by roundiſh ſummits, and a ſharp taper germen, ſupporting an oval-ſhaped ſtyle, crowned by an obtuſe ſtigma. The germen afterward becomes a ſhort ſwelling pod, having two longitudinal rolls, incloſing kidney-ſhaped ſeeds.

There are four ſpecies of this plant enumerated by Mr. Miller: the firſt grow naturally on the ſea-ſhore about Marſeilles, and in Italy; this has a thick, ſhort, ligneous ſtalk, which branches out greatly on every ſide. The young branches are woolly, cloſely garniſhed with winged leaves, whoſe foot-ſtalks end in acute thorns. The lobes are ſmall, oval, obtuſe, and of a ſilvery colour. The flowers are large, white, and ſhaped like a butterfly; they are produced in cluſters at the end of the branches, and are ſucceeded by ſhort pods, having two longitudinal cells, containing two or three kidney-ſhaped ſeeds, which ſeldom ripen in England.

The ſecond ſort grows naturally in the iſlands of Majorca and Minorca; this hath a thick woody ſtalk, riſing about two feet high, ſending out many ligneous branches, cloſely garniſhed with ſmall, ſpear-ſhaped, hoary leaves, ranged by pairs along a very ſtrong foot-ſtalk, ending with a ſharp thorn. The flowers are produced ſingly from the ſides of the branches; they are large, white, and are ſucceeded by oval bladder pods, containing four kidney-ſhaped ſeeds, which do not ripen in England.

The third ſort grows naturally in the iſlands of the Archipelago; this has a very low ſhrubby ſtalk, divided into many downy branches, garniſhed with winged leaves, compoſed of nine or ten pair of ſpear-ſhaped woolly lobes, ending in acute thorns. The flowers are produced from the ſide and at the top of the branches; they are white, and ſhaped like thoſe of the other ſpecies, but ſmaller.

The fourth ſort grows naturally in Spain; this is a very low plant. The ſtalks are pretty thick and woody, but ſeldom riſe more than five or ſix inches high, dividing into ſeveral bunches, cloſely garniſhed with ſmall winged leaves, compoſed of ſeveral pair of ſmall, linear, ſmooth lobes, of a bright green colour. The foot-ſtalks of theſe end in very ſharp thorns, which ſtand out beyond the lobes; the flowers grow in cluſters from the ſide of the ſtalks: they are ſmaller than thoſe of the other ſpecies, and of a dirty white colour.

Theſe ſorts may be propagated by ſeeds, when they can be procured from the countries where the plants grow naturally, which ſhould be ſown on a bed of freſh earth in April; and when the plants come up, they ſhould be carefully kept clean from weeds. If the ſeaſon ſhould prove very dry, it would be of great ſervice to water the plants now and then; when they are large enough to tranſplant, they ſhould be carefully taken up, and ſome of them planted in ſmall pots, filled with freſh earth, placing them in the ſhade until they have taken new root; then they may be removed into an open ſituation, where they may remain till the latter end of October, when they ſhould be placed under a common frame, where they may be ſheltered from ſevere froſt, but may have free air in mild weather.

The remainder of the plants may be planted on a warm dry bank, where they muſt be ſhaded until they take root; and if the ſeaſon ſhould continue dry, they muſt be refreſhed with water, otherwiſe they will be in danger, becauſe, while they are ſo young, their roots will not have eſtabliſhed themſelves in the ground ſufficiently to nouriſh them in great droughts.

Thoſe plants which were planted in pots, may be preſerved under frames in winter, until they have obtained ſtrength, when they may be ſhaken out of the pots, and planted in a lean dry ſoil and a warm ſituation, where they will endure the cold of our ordinary winters very well; but, as they are ſometimes deſtroyed by hard froſts, it will be proper to keep a plant of each kind in pots, which may be ſheltered in winter, to preſerve the ſpecies.

These plants may alſo be propagated by ſlips, for as they rarely produce ſeeds in this country, the latter method is generally uſed here. The beſt time for this work is in April, juſt as the plants begin to ſhoot, at which time the tender branches of the plants ſhould be ſlipped off, and their lower parts diveſted of the decayed leaves; then they ſhould be planted on a very moderate hot-bed, which ſhould be covered with mats, to ſcreen them from the great heat of the ſun by day and the cold by night. Theſe cuttings ſhould be greatly watered until they have taken root; then they may be expoſed to the open air, obſerving always to keep them clear from weeds.

On this bed they may remain until the following ſpring, where, if the winter ſhould be very ſevere, they may be covered with mats as before; and in April they may be tranſplanted out either into pots, filled with ſandy light earth, or into warm borders, where, if the ſoil be dry, gravelly, and poor, they will endure the ſevereſt cold of our climate; but if they are planted in a very rich ſoil, they often decay in winter.

Gum-tragacanth, or, as ſome call it, gum-adragant, or gum-dragon, is the produce of one of the ſpecies of this genus. The gum is brought to us in long and ſlender pieces, of a flatted figure, more or leſs, and theſe not ſtrait, or rarely ſo; but commonly twiſted and contorted various ways, ſo as to reſemble worms. We ſometimes meet with it like the other vegetable exſudations, in roundiſh drops, but theſe are much more rare. It is moderately heavy, of a firm conſiſtence, and, properly ſpeaking, very tough rather than hard, and is extremely difficult to powder, unleſs firſt carefully dried, and the mortar and peſtle kept warm. Its natural colour is a pale whitiſh, and in the cleaneſt pieces it is ſomething tranſparent. It is often, however, met with tinged browniſh, and of other colours, and more opake. It has no ſmell, and very little taſte, but what it has is diſagreeable. Taken into the mouth, it does not grow clammy, and ſtick to the teeth, as the gum-arabic does, but melts into a kind of very ſoft mucilage. It diſſolves in water but ſlowly, and communicates its mucilaginous quality to a great quantity of that fluid. It is by no means ſoluble in oily or ſpirituous liquors, nor is it inflammable. It is brought to us from the iſland of Crete, and from ſeveral parts of Aſia. It is to be choſen in long twiſted pieces, of a whitiſh colour, very clear, and free from all other colours; the brown, and particularly the black, are wholly to be rejected.

Tragacanth has the ſame virtues with gum-arabic, but in a greater degree. It greatly inſpiſſates and obtunds the acrimony of the humours, and is therefore found of vaſt ſervice in inveterate coughs, and other diſorders of the breaſt, ariſing from an acrid phlegm, and in ſtranguries, heat of urine, and all other complaints of that kind. It is uſually given in the compound powder, called the ſpecies diatragacanthi frigidæ, rarely alone. It is alſo, by ſome, eſteemed a very great external remedy for wounds, and in this ſenſe made an ingredient in ſome ſympathetic powders, with vitriol and other things. It is by ſome recommended alone, in form of a powder or ſtrong mucilage, for cracks and chaps in the nipples of women: but it is found, by experience, to be a very troubleſome application in thoſe caſes, and to do more harm than good, as it dries by the heat of the part, and draws the lips of the wound farther aſunder than before.

TRAGEA, in pharmacy, an aromatic powder, groſly beaten and mixed with ſugar, taken by way of carminative.

TRAGEDY, a dramatic poem, repreſenting ſome ſignal action performed by illuſtrious perſons, and which has frequently a fatal iſſue, or end.

Ariſtotle, more ſcientifically, defines tragedy, the imitation of one grave and entire action, of a juſt length, and which without the aſſiſtance of narration, by raiſing of terror and compaſſion, refines and purges our paſſions. This definition has given the critics ſome perplexity; and Corneille declares he cannot reconcile Ariſtotle with himſelf: the inſtances Ariſtotle cites, he thinks, ruin his own definition; he even denies the purging our paſſions to be the end of tragedy. Our Engliſh authors are more favourable to the definition; by the purging our paſſions, they underſtand not the extirpating them, but the reducing them to juſt bounds; for by ſhewing the miſeries that attend a ſubjection to them, it teaches us to watch them more narrowly; and by ſeeing the great misfortunes of others, it leſſens the ſenſe of our own.

Tragedy, in its original, M. Hedelin obſerves, was only a hymn ſung in honour of Bacchus, by ſeveral perſons, who, together, made a chorus of muſic, with dances and inſtruments. As this was long, and might fatigue the ſingers, as well as tire the audience, they bethought themſelves to divide the ſinging of the chorus into ſeveral parts, and to have certain recitations in the intervals. Accordingly Theſpis firſt introduced a perſon upon the ſtage with this view. Æſchylus, finding one perſon inſufficient, introduced a ſecond, to entertain the audience more agreeably, by a kind of dialogue: he alſo cloathed his perſons more decently, and firſt put on them the buſkin.

The perſons who made theſe recitations on the ſcene, were called actors; ſo that tragedy was at firſt without actors. And what they thus rehearſed, being things added to the ſinging of the chorus, of which they were no neceſſary part, were called epiſodes.

Sophocles found that two perſons were not enough for the variety of incidents, and accordingly introduced a third: and here the Greeks ſeem to have ſtopped; at leaſt, it is very rare that they introduced four ſpeakers in the ſame ſcene.

Tragedy and comedy were, at firſt, confounded with each other, but were afterwards ſeparated; and the poets applied themſelves to the cultivating of tragedy, neglecting comedy.

When tragedy was got into a better form, they changed the meaſure of its verſe, and endeavoured to bring the action within the compaſs of a day, or of a revolution of the ſun.

The Engliſh received the firſt plan of their drama from the French, among whom it had its riſe towards the end of Charles V. under the title of Chant-royal, which conſiſted of pieces in verſe, compoſed in honour of the Virgin, or ſome of the ſaints, and ſung on the ſtage: they were called by the title of chant-royal, becauſe the ſubject was given by the king of the year, or the perſon who had borne away the prize the year preceding.

The humour of theſe pieces ran wonderfully among the people, inſomuch that in a little time there were formed ſeveral ſocieties, who began to vie with each other: one of theſe, to engage the town from the reſt, began to intermix various incidents or epiſodes, which they diſtributed into acts, ſcenes, and as many different perſons as were neceſſary for the repreſentation. Their firſt eſſay was in the Bourg St. Mawe, and their ſubject the paſſion of our Saviour. The provoſt of Paris prohibiting their continuing it, they made application to court; and to render it the more favourable to them, elected themſelves into a friary or fraternity, under the title of Brothers of the Paſſion: which title has given ſome occaſion to ſuſpect them to have been an order of religious.

The king, on ſeeing and approving ſome of their pieces, granted them letters of eſtabliſhment, in 1402; upon which they built a theatre, and for an age and a half acted none but grave pieces, which they called moralities; till, the people growing weary of them, they began to intermix farces, or interludes, from prophane ſubjects.

This mixture of farce and religion diſpleaſing many, they were re-eſtabliſhed by an arret of parliament, in 1548, on condition of their acting none but proper, lawful, and decent ſubjects, without intermeddling with any of the myſteries of religion; and thus were the Brothers of the Paſſion deſpoiled of their religious character: upon which they mounted the ſtage no more in perſon, but brought up a new ſet of comedians, who acted under their direction.

Thus was the drama eſtabliſhed, and on this foundation arrived in England. In proceſs of time, as it was improved, it became divided into two branches, agreeable to the practice of the ancients, and the nature of

things, viz. into tragedy and comedy, properly ſo called; and this laſt again was ſub-divided into pure comedy and farce.

TRAGI-COMEDY, a dramatic piece partaking of the nature both of tragedy and comedy, the event of which is not bloody or unhappy, and wherein is admitted a mixture of leſs ſerious characters.

The foundation of tragi-comedy is certainly bad; for endeavouring to make us laugh and cry by turns, it endeavours at contrary motions, which the heart can never undergo; every thing that diſpoſes for the one, indiſpoſing for the other: for which reaſon it is at preſent, with great juſtice, diſuſed. However, tragi-comedy is allowed to introduce kings and heroes.

TRAGOPOGON, Goats Beard, in botany, a genus of plants; the common empalement of the flower is ſingle, compoſed of eight acute pointed leaves, which are alternately large, joined at their baſe. The flower is compoſed of many hermaphrodite florets, which are uniform, of one petal, ſtretched out like a tongue, indented at their points in five parts, and lie over each other like the ſcales of fiſh; theſe have each five ſhort hair-like ſtamina, terminated by cylindrical ſummits, and an oblong germen, ſituated under the floret, ſupporting a ſlender ſtyle the length of the ſtamina, crowned by two revolving ſtigmas. The empalement of the flower afterwards ſwells to a belly, incloſing many oblong, angular, rough ſeeds, ſlender at both ends, crowned by a feathery down.

There are ſix ſpecies of this plant, the firſt growing naturally in the meadows of Auſtria and Germany; this is very different from the ſecond, which grows naturally in England; for the ſeeds of both have been ſown ſeveral years in the ſame bed of earth, and have always been found to retain a difference. The lower leaves of this are three quarters of an inch broad at their baſe, where they embrace the ſtalk, and more than a foot long, cloſed together, ending in acute points. The ſtalk riſes near three feet high, garniſhed at each joint with one leaf, of the ſame ſhape with thoſe below, but ſmaller: it is terminated by one large yellow flower, compoſed of hermaphrodite florets, which lie over each other like the ſcales of fiſh; theſe are included in one common ſimple empalement, which is equal in length to the rays of the flower. Each floret is ſucceeded by an oblong ſeed, which is larger at the baſe than at the point, where it is crowned with a large feathery down. The ſeeds of the border or ray are crooked and rough, but thoſe of the diſk are ſtrait and ſmooth.

The ſecond ſort grows naturally in moiſt paſtures in many parts of England; it is by the common people titled ſleep-at-noon, or go-to-bed-at-noon, becauſe the flowers are generally cloſed up before that time every day. The lower leaves of this ſort are almoſt as long as thoſe of the firſt ſort, but are not more than a third part ſo broad; they are of a deep green colour, and end in acute points. The ſtalks riſe about a foot high, and ſuſtain one yellow flower at the top, not more than half ſo large as thoſe of the firſt; the empalements of theſe flowers are longer than the rays, and the ſeeds are much ſmaller than thoſe of the other.

When this ſort ſhoots up in ſtalks four inches high, the common people gather it out of the fields, and boil it in the ſame way as aſparagus, and ſome give it the preference.

The third ſort is cultivated in gardens by the title of ſalſafy. The roots of this are dreſſed in different ways, and ſerved up to the table; but of late years ſome perſons cultivate it for the ſtalks, which are cut in the ſpring, when they are four or five inches high, which are dreſſed like aſparagus, in the like manner as the ſecond ſort. The ſtalks of this are much longer, and are tenderer than the other, ſo are better for the purpoſe than thoſe of the ſecond ſort; the leaves are broad; the flowers are large and blue; the foot-ſtalk immediately under the flower is much thicker than below, and the empalement is longer than the rays of the flower.

The fourth ſort grows naturally in Italy; this is of low ſtature. The ſtalks ſeldom riſe a foot high; the leaves are long and narrow; the flowers are ſmall, and of a pale red or peach-bloſſom colour; the empalement is much longer than the rays of the flower, and the ſeeds are ſmooth.

The fifth ſort grows naturally in Iſtria; this has narrow hairy leaves. The ſtalks riſe about a foot and a half high, are naked moſt part of their length, very hairy, and ſuſtain one pretty large yellow flower, whoſe empalement is much ſhorter than the rays of the flower, which is alſo very hairy.

The ſixth ſort grows naturally in Crete, and alſo in Italy; this is an annual plant, very like the ſowthiſtle in ſtalk and leaf, but the empalement of the flower is prickly. It is ſeldom admitted into gardens, becauſe the ſeeds are wafted by the winds to a great diſtance, and thereby fill the garden with the plants.

Theſe plants are propagated from ſeeds, which ſhould be ſown in April upon an open ſpot of ground, in rows about nine or ten inches diſtance; and when the plants are come up, they ſhould be hoed out, leaving them about ſix inches aſunder in the rows. The weeds ſhould alſo be carefully hoed down as they are produced, otherwiſe they will ſoon overbear the plants, and ſpoil them. This is all the culture required, and if the ſoil be light and not too dry, the plants will have large roots before winter; at which time the ſalſafy, whoſe roots are eaten at that ſeaſon, will be fit for uſe, and may be taken up at any time after their leaves begin to decay; but, when they begin to ſhoot again, they will be ſticky, and not fit for uſe; but many perſons cultivate this ſort for the ſhoots, as was before mentioned.

The common yellow ſort, whoſe ſhoots are ſold in the market, will be fit for uſe in April or May, according to the forwardneſs of the ſeaſon. The beſt time to cut them is, when their ſtems are about four inches long, for if they ſtand too long, they are never ſo tender as thoſe which are cut while young.

Some people, in cultivating theſe plants, ſow their ſeeds in beds pretty cloſe; and when they come up, they tranſplant them out in rows at the before mentioned diſtance; but, as they form tap-roots, which abound with a milky juice, when the extreme part of their roots is broken by tranſplanting, they ſeldom thrive well afterward; therefore, it is by far the better way to make ſhallow drills in the ground, and ſcatter the ſeeds therein, as before directed, whereby the rows will be at a due diſtance, and there will be nothing more to do than to hoe out the plants when they are too thick in the rows, which will be much leſs trouble than the other method of tranſplanting, and the plants will be much larger and fairer.

TRAGUS, τραγος, in anatomy, one of the protuberances of the auricle, or external ear, called alſo hircus, becauſe uſually hairy. The tragus is that protuberance next the temple: that on the oppoſite ſide, to which the ſoft lobe of the ear is annexed, is called the antitragus. See the article EAR.

TRAJAN COLUMN, a famous hiſtorical column erected in Rome, in honour of the emperor Trajan. It is of the Tuſcan order, though ſomething irregular; its height is eight diameters, and its pedeſtal Corinthian: it was built in a large ſquare there, called Forum Romanum. Its baſe conſiſts of twelve ſtones, of an enormous ſize, and it is raiſed on a ſocle, or foot of eight ſteps; within ſide is a ſtair-caſe, illuminated with forty-four windows. It is 140 feet high, which is thirty-five ſhort of the Antonine column, but the workmanſhip of the former is much more valued. It is adorned from top to bottom with baſſo relievo's repreſenting the great actions of that emperor againſt the Dacæ.

TRAJECTORY *of a Comet*, is its path or orbit, or the line it deſcribes in its motion. See the article COMET.

TRAIL-BOARD, in a ſhip, a carved board on each ſide of her beak, which reaches from the main ſtem to the figure, or the brackets.

TRAIN, the attendance of a great perſon, or the trail of a gown, or robe of ſtate. In falconry, it denotes the tail of an hawk.

TRAIN, is likewiſe uſed for the number of beats which a watch makes in an hour, or any other certain time.

TRAIN, is alſo uſed for a line of gun-powder, laid to give fire to a quantity thereof, in order to do execution by blowing up earth, works, buildings, &c.

TRAIN, OR TRAILE OF ARTILLERY, includes the great guns, and other pieces of ordnance belonging to an army in the field. See the article CANNON.

TRAIN-OIL, the oil procured from the blubber of a whale by boiling.

TRAIN-BANDS, or TRAINED-BANDS, a name given to the militia of England.

TRAINING, or TRACING, in mineralogy, a term uſed by the miners to expreſs the tracing up the mineral appearances on the ſurface of the earth to their head, or original place, and there finding a mine of the metal they contain.

TRAITOR, or TRAYTOR, a perſon guilty of treaſon.

TRAMBLING *of Tin Ore*, among miners, the waſhing it very clean, which is done in a ſhovel, and in a frame of boards. See the article TIN.

TRAMEL, an inſtrument, or device, ſometimes of leather, more uſually of rope, fitted to a horſe's legs, to regulate his motions, and form him to an amble. It is alſo taken in many places for an iron moveable inſtrument in chimnies to hang pots over the fire.

TRAMEL-NET, is a long net wherewith to take fowl by night in champain countries, much like the net uſed for the low bell, both in ſhape, bigneſs, and meſhes. To uſe it, they ſpread it on the ground, ſo as the nether or farther end fitted with ſmall plumbets, may lie looſe thereon; then the other part being borne up by men placed at the fore ends, it is thus trailed along the ground. At each ſide are carried great blazing lights, by which the birds are raiſed, and as they riſe under the net they are taken.

TRAMONTANE, or TRAMONTAIN, ſomething beyond, or on the farther ſide the mountains, applied particularly by the Italians, to ſuch as live on the other ſide the Alps, i. e. all out of Italy, as the Germans, Flemiſh, French, &c.

TRANGLE, in heraldry, the diminutive of a feſs, commonly called a bar.

TRANSACTION, *Tranſactio*, in the civil law, an accommodation of ſome buſineſs, or diſpute between two parties, by a mutual and voluntary agreement between them. See ACCOMMODATION.

Philoſophical TRANSACTIONS, a kind of journal of the principal things that come before the Royal Society of London. See the article SOCIETY.

It appears, that the printing of theſe tranſactions was always, from time to time, the ſingle act of the reſpective ſecretaries of the ſociety, till the publication of the 47th volume, in 1753, notwithſtanding it has been the common opinion, that they were publiſhed by the authority and under the direction of the ſociety itſelf. The truth is, that the ſociety, as a body, never did intereſt themſelves further in their publication, than by occaſionally recommending the revival of them to ſome of their ſecretaries, when, from the particular circumſtances of their affairs, the tranſactions had happened for any length of time to be intermitted, and this ſeems principally to have been done with a view to ſatisfy the public, that their uſual meetings were then continued for the improvement of knowledge and benefit of mankind, the great ends of their firſt inſtitution; but the ſociety being of late years greatly enlarged, and their communications more numerous, they thought it adviſable, that a committee of their members ſhould be appointed to re-conſider the papers read before them, and ſelect out of them ſuch as they ſhould judge proper for publication in the future tranſactions, which was accordingly done upon the 26th of March, 1752.

TRANSCENDANT, or TRANSCENDENTAL, ſomething raiſed or elevated beyond other things; or which paſſes and tranſcends the nature and circumſtances of other inferior beings, ſo as not to be intimately and eſſentially included under them.

TRANSCENDENTAL QUANTITIES, among geometricians, are indeterminate ones; or ſuch as cannot be expreſſed, or fixed to any conſtant equation.—Such is the tranſcendental curve, or the like.

M. Leibnitz has a diſſertation in the *Acta Erudit. Lipſ.* wherein ſome problems are neither plain, ſolid, nor ſurſolid; nor of any certain degree, but tranſcend all algebraical equations. He alſo ſhews how it may be demonſtrated without calculus that an algebraic quadratrix for the circle or hyperbola is impoſſible: for, if ſuch quadratrix could be found, it would follow that by means thereof any angle, ratio, or logarithm, might be divided in a given proportion of one right-line to another, and this by an univerſal conſtruction, and, conſequently, the problem of the ſection of an angle, or the invention of any number of mean proportionals, would be a certain finite degree: whereas the different degrees of algebraical equations, and, therefore, the problem underſtood in general of any number of parts of an angle, or mean proportionals, is of an indefinite degree, and tranſcends all algebraical equations.

TRANSCENDENTAL *Curve*, in the higher geometry, is ſuch a one as cannot be defined by any algebraic equation; or which, when expreſſed by an equation, one of the terms thereof is a variable quantity.

Theſe curves are the ſame with what Des Cartes, and, after his example, ſeveral others call mechanical curves, and which they would have excluded out of geometry; but Sir Iſaac Newton and M. Leibnitz are of another ſentiment, for, in effect, in the conſtruction of geometrical problems, one curve is not to be preferred to another, as it is defined by a more ſimple equation, but as it is more eaſily deſcribed than that other. And ſome of theſe tranſcendental, or mechanical, curves are found of greater uſe than all the algebraical ones together, except the circle.

Add, that M. Leibnitz, in the *Acta Eruditor. Lipſ.* gives us a kind of tranſcendental equations, whereby theſe tranſcendental curves are actually defined, and which are of an indefinite degree; that is, are not always the ſame in all the points of the curve.

Whereas algebraiſts uſe to aſſume ſome general letters or numbers for the quantities ſought, in theſe tranſcendental problems, M. Leibnitz aſſumes general or indefinite equations for the lines ſought; e. gr. putting x and y for the abſciſſe and ordinate, the equation he uſes for a line ſought is $a+bx+cy+exy+fxx+gyy$, &c. $=0$. By the help of which, indefinite equation, in reality, is finite; for it always may be determined, how far ſoever it is neceſſary to raiſe it, he ſeeks the tangent; and that which reſults comparing with the given property of tangents, he finds the value of aſſumed letters a, b, c, &c. and thus defines the equation of the line ſought.

If the compariſon, abovementioned, do not proceed, he pronounces the line ſought, not to be an algebraical, but a tranſcendental one.

This ſuppoſed, he goes on to find the ſpecies of tranſcendency: for ſome tranſcendentals depend on the general diviſion or ſection of a ratio, or upon the logarithms; others upon the arcs of a circle, and others on more indefinite and compound inquiries.

He therefore, beſides the ſymbols x and y, aſſumes a third, as v, which denotes the tranſcendental quantity; and of theſe three forms a general equation for the line ſought, from which he finds the tangent, according to the differential method; which ſucceeds even in tranſcendental quantities. What he finds he compares with the given properties of the tangent, and ſo diſcovers, not only the values of a, b, c, &c. but alſo, the particular nature of the tranſcendental quantity.

And though it may ſometimes happen, that the ſeveral tranſcendentals are ſo to be made uſe of, and thoſe of different natures too, one from another; alſo, though there be tranſcendents or tranſcendentals, and a progreſſion of theſe in infinitum: yet we may be ſatisfied with the moſt eaſy and uſeful one, and, for the moſt part, may have recourſe to ſome peculiar artifices for ſhortening the calculus, and rendering the problem to as ſimple a term as may be.

This method being applied to the buſineſs of quadratures, or to the invention of quadrices, in which the property of the tangent is always given, it is manifeſt, not only how it may be diſcovered, whether the indefinite quadrature may be algebraically impoſſible, but, alſo how, when this impoſſibility is diſcovered, a tranſcen-

dental

dental quadratrix may be found; which is a thing which had not before been ſhewn. So that it ſeems that geometry, by this method, is carried infinitely beyond the bounds to which Vieta and Des Cartes brought it; ſince, by this means, a certain and general analyſis is eſtabliſhed, which extends to all the problems which are of no certain degree, and, conſequently, not comprehended within algebraical equations.

Again, in order to manage tranſcendental problems (wherever the buſineſs of tangents or quadratures occurs) by a calculus, there is hardly any that can be imagined ſhorter, more advantageous, or univerſal, than the differential calculus, or analyſis of indiviſibles and infinites.

By this method we may explain the nature of tranſcendental lines by an equation: e. gr. Let z be the arc of a circle whoſe radius is r, and x the verſed ſine: then will $\dot{z} = \frac{r\dot{x}}{\sqrt{2rx+x^2}}$; and, if the ordinate of the cycloid be y, then will $y = \sqrt{2rx+x^2} + z$, or the fluent of $\frac{r\dot{x}}{\sqrt{2rx-x^2}}$, which equation perfectly expreſſes the relation between the ordinate y and the abſciſſe x, and from it all the properties of the cycloid may be demonſtrated.

Thus is the analytical calculus extended to thoſe lines, which have hitherto been excluded, for no other cauſe, but that they were thought incapable of it.

TRANSCOLATION, in pharmacy, the ſame with filtration, or percolation. See the article FILTRATION.

TRANSCRIPT, a copy of any original writing, particularly that of an act, or inſtrument, inſerted in the body of another.

TRANSFER, in commerce, &c. an act whereby a perſon ſurrenders his right, intereſt, or property in any thing moveable or immoveable to another.

The term transfer, is chiefly uſed for the aſſigning and making over ſhares in the ſtocks, or public funds, to ſuch as purchaſe them of the proprietors.

TRANSFORMATION, in general, denotes a change of form, or the aſſuming a new form different from a former one. The chemiſts have been for a long time ſeeking the transformation of metals; that is, their tranſmutation, or the manner of changing them into gold. See TRANSMUTATION.

TRANSFORMATION *of Equations*. The doctrine of the transformation of equations, and of exterminating their intermediate terms, is thus taught by Mr. Mac Laurin. The affirmative roots of an equation are changed into negative roots of the ſame value, and the negative roots into affirmative, by only changing the ſigns of the terms alternately, beginning with the ſecond. Thus, the roots of the equation $x^4-x^3-19x^2+49x-30=0$, are $+1$, $+2$, $+3$, $+5$; whereas the roots of the ſame equation having only the ſigns of the ſecond and fourth terms changed, viz. $x^4+x^3-19x^2-49x-30=0$, are -1, -2, -3, $+5$.

To underſtand the reaſon of this rule, let us aſſume an equation, as $\overline{x-a}\times\overline{x-b}\times\overline{x-c}\times\overline{x-d}\times\overline{x-e}$, &c. $=0$, whoſe roots are $+a$, $+b$, $+c$, $+d$, $+e$, &c. and another having its roots of the ſame value, but affected with contrary ſigns, as $\overline{x+a}\times\overline{x+b}\times\overline{x+c}\times\overline{x+d}\times\overline{x+e}$, &c. $=0$. It is plain, that the terms taken alternately, beginning from the firſt, are the ſame in both equations, and have the ſame ſign, being products of an even number of the roots; the product of any two roots having the ſame ſign as their product when both their ſigns are changed; as $+a\times-b=-a\times+b$.

But the ſecond terms and all taken alternately from them, becauſe their coefficients involve always the products of an odd number of the roots, will have contrary ſigns in the two equations. For example, the product of four, viz. $abcd$, having the ſame ſign in both, and one equation in the fifth term having $abcd\times+e$, and the other $abcd\times-e$, it follows, that their product $abcde$ muſt have contrary ſigns in the two equations: Theſe two equations, therefore, that have the ſame roots, but with contrary ſigns, have nothing different but the ſigns of the alternate terms, beginning with the ſecond. From which it follows, that if any equation is given, and you change the ſigns of the alternate terms, beginning with the ſecond, the new equation will have roots of the ſame value, but with contrary ſigns.

It is often very uſeful to transform an equation into another that ſhall have its roots greater or leſs than the roots of the propoſed equation by ſome given difference.

Let the equation propoſed be the cubic $x^3-px^2+qx-r=0$. And let it be required to transform it into another equation, whoſe roots ſhall be leſs than the roots of this equation by the given difference (e); that is, ſuppoſe $y=x-e$, and conſequently, $x=y+e$; then, inſtead of x, and its powers, ſubſtitute $y+e$, and its powers, there will ariſe this new equation:

$$(A)\left.\begin{array}{r} y^3+3ey^2+3e^2y+e^3 \\ -py^2-2pey-pe^2 \\ +qy+qe \\ -r \end{array}\right\}=0$$

whoſe roots are leſs than the roots of the preceding equation by the difference (e).

If it had been required to find an equation whoſe roots ſhould be greater than thoſe of the propoſed equation by the quantity (e), then we muſt have ſuppoſed $y=x+e$, and conſequently, $x=y-e$, and then the other equation would have had this form:

$$(B)\left.\begin{array}{r} y^3-3ey^2+3e^2y-e^3 \\ -py^2+2pey-pe^2 \\ +qy-qe \\ -r \end{array}\right\}=0$$

If the propoſed equation be in this form, $x^3+px^2+qx+r=0$, then, by ſuppoſing $x+e=y$, there will ariſe an equation agreeing, in all reſpects, with the equation (A), but that the ſecond and fourth terms will have contrary ſigns.

And by ſuppoſing $x-e=y$, there will ariſe an equation agreeing with (B), in all reſpects; but that the ſecond and fourth terms will have contrary ſigns to what they have in (B).

The firſt of theſe ſuppoſitions gives this equation,

$$(C)\left.\begin{array}{r} y^3-3ey^2+3e^2y-e^3 \\ +py^2-2pey+pe^2 \\ +qy-qe \\ +r \end{array}\right\}=0$$

The ſecond ſuppoſition gives the equation,

$$(D)\left.\begin{array}{r} y^3+3ey^2+3e^2y+e^3 \\ +py^2+2epy+pe^2 \\ +qy+qe \\ +r \end{array}\right\}=0$$

The firſt uſe of this transformation of equations is to ſhew how the ſecond (or other intermediate) term may be taken away out of an equation.

It is plain, that in the equation (A), whoſe ſecond term is $\overline{3e-p}\times y^2$, if you ſuppoſe $e=\frac{1}{3}p$, and conſequently, $3e-p=0$, then the ſecond term will vaniſh.

In the equation (C), whoſe ſecond term is $-3e+p\times y^2$, ſuppoſing $e=\frac{1}{3}p$, the ſecond term alſo vaniſhes.

Now the equation (A) was deduced from $x^3-px^2+qx-r=0$, by ſuppoſing $y=x-e$: and the equation (C) was deduced from $x^3+px^2+qx+r=0$, by ſuppoſing $y=x+e$. From which this rule may eaſily be deduced for exterminating the ſecond term out of any cubic equation.

Rule. Add to the unknown quantity of the given equation the third part of the coefficient of the ſecond term, with its proper ſign, viz. $\mp\frac{1}{3}p$, and ſuppoſe this aggregate equal to a new unknown quantity (y). From this value of y, find a value of x by tranſpoſition, and ſubſtitute this value of x, and its powers, in the given equation, and there will ariſe a new equation that ſhall want the ſecond term.

Example. Let it be required to exterminate the ſecond term out of this equation, $x^3-9x^2+26x-34=0$, ſuppoſe $x-3=y$, or $y+3=x$; and ſubſtituting according to the rule, you will find

$$\left.\begin{array}{r} y^3+9y^2+27y+27 \\ -9y^2-54y-81 \\ +26y+78 \\ -34 \end{array}\right\}=0$$

$$y^{3*} \quad -y \quad -10 \quad =0$$

In which there is no term where y is of two dimenſions, and an aſteriſk is placed in the room of the ſecond term, to ſhew it is wanting.

Let the equation propoſed be of any number of dimenſions repreſented by (n); and let the coefficient of the ſecond term, with its ſign prefixed, be $-p$; then ſuppoſing $x-\frac{p}{n}=y$, and, conſequently, $x=y+\frac{p}{n}$, and ſubſtituting this value for x in the given equation, there will ariſe a new equation that ſhall want the ſecond term.

It is plain, that the ſum of the roots of the propoſed equation, is $+p$; and ſince we ſuppoſe $y=x-\frac{p}{n}$; it follows, that in the new equation each value of y will be leſs than the reſpective value of x by $\frac{p}{n}$; and ſince the number of the roots is n, it follows, that the ſum of the values of y will be leſs than $+p$, the ſum of the values of x, by $n\times\frac{p}{n}$, the difference of any two roots; that is, by $+p$: therefore, the ſum of the values of y will be $+p-p=0$.

But the coefficient of the ſecond term of the equation of y is the ſum of the values of y, viz. $+p-p$, and, therefore, that coefficient is equal to nothing; and, conſequently, in the equation of y, the ſecond term vaniſhes. It follows then, that the ſecond term may be exterminated out of any given equation by the following

Rule. Divide the coefficient of the ſecond term of the propoſed equation by the number of dimenſions of the equation; and aſſuming a new unknown quantity y, add to it the quotient, having its ſign changed. Then ſuppoſe this aggregate equal to x, the unknown quantity in the propoſed equation; and for x, and its powers, ſubſtitute the aggregate and its powers, ſo ſhall the new equation, that ariſes, want its ſecond term.

If the propoſed equation is a quadratic, as $x^2-px+q=0$, then, according to the rule, ſuppoſe $y+\frac{1}{2}p=x$, and, ſubſtituting this value for x, you will find

$$\left.\begin{array}{r} y^2+py+\frac{1}{4}p^2 \\ -py-\frac{1}{2}p^2 \\ +q \end{array}\right\}=0$$

$$y^2 \quad *-\tfrac{1}{4}p^2+q=0$$

And from this example, the uſe of exterminating the ſecond term appears: for, commonly, the ſolution of the equation, that wants the ſecond term, is more eaſy. And, if you can find the value of y from this new equation, it is eaſy to find the value of x by means of the equation $y+\frac{1}{2}p=x$. For example,

Since $y^2+q-\frac{1}{4}p^2=0$, it follows, that $y^2=\frac{1}{4}p^2-q$, and $y=\pm\sqrt{\frac{1}{4}p^2-q}$, ſo that $x=y+\frac{1}{2}p=\frac{1}{2}p\pm\sqrt{\frac{1}{4}p^2-q}$.

If the propoſed equation is a biquadratic, as $x^4-px^3+qx^2-rx+s=0$, then by ſuppoſing $x-\frac{1}{4}p=y$, or $x=y+\frac{1}{4}p$, an equation ſhall ariſe having no ſecond term. And if the propoſed is of five dimenſions, then you muſt ſuppoſe $x=y\pm\frac{1}{5}p$. And ſo on.

When the ſecond term in any equation is wanting, it follows, that the equation has both affirmative and negative roots, and that the ſum of the affirmative roots is equal to the ſum of the negative roots: by which means, the coefficient of the ſecond term, which is the ſum of all the roots of both ſorts, vaniſhes, and makes the ſecond term vaniſh.

In general, the coefficient of the ſecond term is the difference between the ſum of the affirmative roots and the ſum of the negative roots: and the operations we have given ſerve only to diminiſh all the roots, when the ſum of the affirmative is greateſt, or increaſe the roots when the ſum of the negative is greateſt, ſo as to balance them, and reduce them to an equality.

It is obvious, that, in a quadratic equation that wants a ſecond term, there muſt be one root affirmative, and one negative; and theſe muſt be equal to one another.

In a cubic equation that wants the ſecond term, there muſt be either two affirmative roots equal, taken together, to a third root that muſt be negative; or, two negative equal to a third that muſt be poſitive.

Let an equation $x^3-px^2+qx-r=0$ be propoſed, and let it be now required to exterminate the third term.

By ſuppoſing $y=x-e$, the coefficient of the third term in the equation of y is found (ſee equation A) to be $3e^2-2pe+q$. Suppoſe that coefficient equal to nothing, and by reſolving the quadratic equation $3e^2-2pe+q=0$, you will find the value of e, which, ſubſtituted for it in the equation $y=x-e$, will ſhew how to transform the propoſed equation into one that ſhall want the third term.

The quadratic $3e^2-2pe+q=0$ gives $e=\frac{p\pm\sqrt{p^2-3q}}{3}$. So that the propoſed cubic will be transformed into an equation wanting the 3d term, by ſuppoſing $y=x-\frac{p-\sqrt{p^2-3q}}{3}$, or $y=x-\frac{p+\sqrt{p^2-3q}}{3}$.

If the propoſed equation is of n dimenſions, the value of e, by which the third term may be taken away, is had by reſolving the quadratic equation $e^2+\frac{2p}{n}\times e+\frac{2q}{n\times n-1}=0$, ſuppoſing $-p$ and $+q$ to be the coefficients of the ſecond and third terms of the propoſed equation.

The fourth term of any equation may be taken away by ſolving a cubic equation, which is the coefficient of the fourth term in the equation when transformed. The fifth term may be taken away by ſolving a biquadratic; and, after the ſame manner, the other terms can be exterminated, if there are any.

TRANSFORMATION *of Inſects.* It is well known that flies are not produced in that form, from the eggs of their parent fly, but undergo a change like that of the butterfly, and the like winged inſects; the egg hatching into a worm; and this after eating, and performing all the operations of animal life for a certain time, enters into a ſtate of reſt, and thence is changed into a fly.

Though the general courſe of nature is the ſame in this reſpect in flies and butterflies, yet the means and manner of it are different: the butterfly makes its coat for this transformation; the fly-worms of many kinds have only a ſhell of their own proper ſkin to undergo this change in.

All the fly-worms of the firſt and ſecond, and many of thoſe of the third claſs, have their caſe thus made only of their own ſkin; the different ſpecies afford indeed ſome varieties in the manner of this, but a general idea of the work may be had from obſerving the worm or maggot of the common fleſh-fly in its ſeveral ſtages.

When this creature has arrived at its full growth, it finds it not convenient any longer to remain among the food it has till then lived upon; it quits it, and now goes in ſearch of a place where it may wait for its metamorphoſis. To this purpoſe it creeps into the earth, where it remains two or three days without any change; at the end of this time, inſtead of its pointed figure, its white colour, and ſoft fleſhy ſubſtance, it acquires the figure of an egg, and becomes of a cheſnut colour, or ſomewhat reddiſh, and looks opaque and cruſtaceous: it is in this ſtate perfectly ſtiff, and deſtitute of motion, and the creature ſeems not only to have loſt its form, but wholly to have loſt its life alſo.

This however is not the caſe; all that is done, is that the creature has abſolutely quitted its ſkin, which is now become hard and of a determinate figure, and is within it compleating all its changes. *Reaumur's Hiſtory of Inſects.*

TRANSFUSION, *Tranſfuſio*, the act of pouring a liquor out of one veſſel into another.

TRANSFUSION *of the Blood*, in ſurgery, the conveying the arterial blood of one man or animal into the veins of another.

Notwithſtanding injections and tranfuſions are ſeldom practiſed by our modern ſurgeons, they were highly celebrated,

lebrated, and often performed in the laſt century. The generality of phyſicians, not without reaſon, attribute moſt diſorders of the body to ſome vice in the blood, and therefore, ſome were led to think, that no method could be more ready to remove and correct that vice, than injecting a proper medicine in the veins, to mix with the blood itſelf, or the transfuſing the ſound blood of one animal into the veins of another, inſtead of that which is diſeaſed. But notwithſtanding the vaſt expectations which had been formed by phyſicians from this operation, frequently the event turned out worſe than the diſeaſe; for we are told, that almoſt all the patients who have been treated this way, degenerated into a ſtupidity, fooliſhneſs, or a raving, or melancholy madneſs, or have been taken off with a ſudden death, either in, or not long after, the operations.

For the transfuſion of blood into the veins, firſt, a vein is to be opened in the patient's arm, or hand, and then a ſmall tube of ſilver, braſs, or ivory, thruſt upward into it: the ſame is to be done with the ſound perſon, only the tube muſt here be inſerted downward, towards the ſmall end of the vein; this done, the ſmalleſt of the tubes is to be inſerted into the other larger one, by which means, as much blood will paſs from the ſound perſon into the patient, as may be thought proper, and then the inciſed veins are to be dreſſed, or bound up, as in bleeding: if the patient does not recover after one transfuſion, the operation ſhould be repeated again, at convenient intervals; but before the patient receives the blood of the ſound perſon, he ought to be bled proportionably, that the new blood laſt received, may have the freer circulation. Sometimes a vein is opened in each arm of the patient at the ſame time, that as much of the vitiated blood may flow out of the orifice as he receives of the ſound by the other. If the blood is to be tranſfuſed out of ſome animal into the patient, then a calf or a lamb, for example, is to be ſecured by ligatures, and one of their veins or arteries opened in the neck, leg, or thigh, and the reſt of the operation managed as before.

TRANSGRESSION, *Tranſgreſſio*, an offence againſt ſome law, or a breach or violation thereof.

TRANSIT, *Tranſitus*, in aſtronomy, ſignifies the paſſage of any planet juſt by, or over a fixed ſtar, or the ſun, and of the moon in particular, covering or moving over any planet.

TRANSITION, in muſic, is when a greater note is broken into a leſs, to ſoften the roughneſs of a leap by a gradual paſſage to the next note following; whence it is commonly called the breaking of a note.

TRANSITION, in rhetoric, is of two ſorts. The firſt is when a ſpeech is introduced abruptly, without expreſs notice given of it; as when Milton gives an account of our firſt anceſtors evening devotions.

Both turned, and under open ſky ador'd
The God that made both air, ſky, earth and heaven. ——
——— Thou alſo mad'ſt the night,
Maker Omnipotent, and thou the day!

The ſecond ſort of tranſition is, when a writer ſuddenly leaves the ſubject he is upon, and paſſes unto another, from which it ſeems different at firſt view, but has a relation and connection with it, and ſerves to illuſtrate and enlarge it.

TRANSITIVE, in grammar, an epithet applied to ſuch verbs as ſignify an action which paſſes from the ſubject that does it, to or upon another ſubject which receives it. Under the head of verbs tranſitive, come what we uſually calls verbs active and paſſive; other verbs, whoſe action does not paſs out of themſelves, are called neuters, and by ſome grammarians, intranſitives.

TRANSLATION, the act of transferring or removing a thing from one place to another; we ſay the tranſlation of a biſhop's ſee, a council, a ſeat of juſtice, &c.

TRANSLATION is alſo uſed for the verſion of a book, a writing out of one language into another.

TRANSMARINE, ſomething that comes from, or belongs to the parts beyond ſea.

TRANSMIGRATION, the removal or tranſlation of a whole people into another country, by the power of a conqueror.

TRANSMIGRATION, is particularly uſed for the paſſage of a ſoul out of one body into another, being the ſame with what we otherwiſe call metempſychoſis.

TRANSMISSION, in optics, &c. the act of a tranſparent body paſſing the rays of light through its ſubſtance, or ſuffering them to paſs; in which ſenſe the word ſtands oppoſed to reflection. Tranſmiſſion is alſo frequently uſed in the ſame ſenſe with reflection, by which moſt bodies, in tranſmitting the rays, do alſo refract them.

The rays of light, Sir Iſaac Newton obſerves, are ſubject to fits of eaſy tranſmiſſion and reflection.

TRANSMUTATION, the act of transforming, or changing one nature into another. Nature, Sir Iſaac Newton obſerves, ſeems delighted with tranſmutations: he goes on to enumerate ſeveral kinds of natural tranſmutations; groſs bodies, and light, he ſuſpects, may be mutually tranſmuted into each other; and adds, that all bodies receive their active force from the particles of light, which enter their compoſition. For all fixed bodies, when well heated, emit light as long as they continue ſo; and again, light intermingles itſelf, and inheres in bodies, as often as its rays fall on the ſolid particles of thoſe bodies. Again, water, which is a fluid, volatile, taſteleſs ſalt, is by heat, tranſmuted into a vapour, which is a kind of air, and by cold, into ice, which is a cold tranſparent brittle ſtone, eaſily diſſolvible, and this ſtone is convertible again into water by heat, as vapour is by cold.

Earth, by heat, becomes fire; and by cold, is converted into earth again; denſe bodies, by fermentation, are rarified into various kinds of air; and that air, by fermentation alſo, and ſometimes without, reverts into groſs bodies. Quickſilver ſometimes puts on the form of a fluid metal, ſometimes it appears in ſhape of a pellucid fragile ſalt, called ſublimate; ſometimes of a pellucid volatile white taſteleſs earth, called mercurius dulcis; by diſtillation it becomes vapour, and by agitation in vacuo, it ſhines like fire, &c.

All bodies, beaſts, fiſhes, inſects, plants, &c. with all their various parts, grow and increaſe out of water, and aqueous and ſaline tinctures; and by putrefaction, all of them revert into water or an aqueous liquor again. Farther, water expoſed a while to the open air, puts on a tincture, which, in proceſs of time, has a ſediment and a ſpirit, and before putrefaction, yields nouriſhment both for animals and vegetables.

TRANSMUTATION, in alchemy, denotes the art of changing or exalting imperfect metals into gold or ſilver. This is alſo called the grand operation, and, they ſay, is to be effected with the philoſopher's ſtone.

Some alchemiſts hold, that the tranſmutation ſhould rather be called the perfection of imperfect metals; as holding all metals intended by nature, to arrive equally at the perfection of gold, inaſmuch as they are compoſed of the ſame matter; and that it is only the impurity of their matrices, that is, of the place wherein they are formed by nature, that has prevented their arriving thereat. The elixir being projected on any of theſe metals, it is ſuppoſed to purge and ſeparate the impure parts from the pure, and to join itſelf wholly to the mercury, which is the pureſt part, as being of the ſame nature.

Whether or no metals may be tranſmuted into one another, is a point ſtrongly diſputed among philoſophers; the alchemiſts ſtrenuouſly aſſerting the affirmative. Some metals it is commonly ſuppoſed, may be changed into others, e. gr. iron into copper, and lead into tin; but Cardan, and ſome others, deny even this, and argue farther, that though iron and braſs, as being nearly alike in weight and tenacity, &c. provided their colour and hardneſs could be changed, might be converted into one another, either really or at leaſt apparently; yet would the tranſmuting or ripening of other metals into gold or ſilver, be ſtill not leſs impoſſible; both as theſe metals are all to be firſt calcined, after which they can never again be brought back to their priſtine purity, and as there is a generation required which is not the work of art but of nature. Cardan, Lemery, Dickenſon, and others, give us accounts of the various impoſtures of

adepti in the buſineſs of tranſmutation; ſome, for inſtance, fixing mercury with verdigreaſe, and then heightening the colour with cadmia, &c. but this, if tried with the coppel, all goes off in fumes; and, in effect, nothing produced this way ought to be adjudged true gold, unleſs it endure coppelling and cementation, purification with antimony, and the depart. Add, that it muſt have the malleability, extreme ductility, and ſpecific gravity of gold.

TRANSMUTATION, in geometry, denotes the reduction or change of one figure or body into another of the ſame area or ſolidity, but of a different form; as a triangle into a ſquare, a pyramid into a parallelopiped, &c. In the higher geometry, tranſmutation is uſed for the converting a figure into another of the ſame kind and order, whoſe reſpective parts riſe to the ſame dimenſions in an equation, admit of the ſame tangents, &c. If a rectilinear figure be tranſmuted into another, it is ſufficient that the interſections of the lines which compoſe it be transferred, and the lines drawn through the ſame in the new figure. If the figure to be tranſmuted be curvilinear, the points, tangents, and other right lines by means of which the curve line is to be defined, muſt be tranſferred.

TRANSOM, among builders, denotes the piece that is framed acroſs a double light window.

TRANSOM, among mathematicians, ſignifies the vane of a croſs-ſtaff, or a wooden number fixed acroſs, with a ſquare whereon it ſlides, &c.

TRANSOM, in a ſhip, a piece of timber, which lies athwart the ſtern, between the two faſhion-pieces, directly under the gun-room-port.

TRANSPARENCY, in phyſics, a quality in certain bodies, whereby they give paſſage to the rays of light.

The tranſparency of natural bodies, as glaſs, water, air, &c. ſome have imputed to the great number and ſize of the pores or interſtices between the particles of theſe bodies: but this account is exceedingly defective; for the moſt ſolid and opake body in nature, we know, contains a great deal more pores than it does matter; a great deal more than is neceſſary for the paſſage of ſo infinitely fine and ſubtile a body as light.

Ariſtotle, Des Cartes, &c. place tranſparency in the rectitude or ſtraightneſs of the pores, by means of which, ſay they, the rays are enabled to make their way through, without ſtriking againſt the ſolid parts, and being reflected back again. But this account, Sir Iſaac Newton ſhews, is lame: the quantity of pores, in all bodies, being ſufficient to tranſmit all the rays that fall on them, however thoſe pores be ſituated with reſpect to each other.

The cauſe, then, why all bodies are not tranſparent, muſt not be aſcribed to their wanting rectilinear pores, but either to the unequal denſity of the parts, or to the pores being filled with ſome foreign matter, or their being quite empty; by means of which, the rays paſſing through, undergoing a great variety of reflections and refractions, are perpetually diverted this way and that, till at length falling on ſome of the ſolid parts of the body, they are extinguiſhed and abſorbed.

Thus cork, paper, wood, &c. are opake, whereas glaſs, diamonds, &c. are tranſparent; the reaſon is, that in the neighbourhood of parts equal in denſity, ſuch as thoſe in glaſs, water, diamonds, &c. are, with reſpect to each other; the attraction being equal on every ſide, no reflection or refraction enſues; but the rays, which entered the firſt ſurface of the bodies, proceed, without interruption, quite through the body; theſe few only excepted, which chance to meet with the ſolid parts. But in the neighbourhood of parts that differ much in denſity, ſuch as the parts of wood and paper are both in reſpect of themſelves, and of the air, or the empty ſpace in their pores; as the attraction will be very unequal, the reflections and refractions muſt be very great; and, therefore, the rays will not be able to make their way through ſuch bodies, but will be perpetually deflected, and at laſt quite ſtopped.

TRANSPIRATION, the inſenſible, or almoſt inſenſible paſſage of an excrementitious matter thro' the pores of the ſkin, called alſo perſpiration.

TRANSPIRATION is alſo uſed by ſome authors for the ingreſs or entrance of the air, vapour, &c. through the pores of the ſkin into the body. Cardan, by this kind of tranſpiration, accounts for the prodigy of a woman whoſe daily urine weighed twenty-ſeven pounds, tho' all the food ſhe took, both dry and liquid, did not exceed four pounds. Dr. Baynard alſo ſuſpects ſome ſuch tranſpiration to be the caſe in hydropical perſons.

TRANSPLANTATION, in agriculture and gardening, the act of removing trees or plants from the places where they were ſowed, or raiſed, and planting them in others. See PLANTING.

TRANSPLANTATION, in natural magic, is uſed for a method of curing diſeaſes by transferring them from one ſubject to another, which was much in vogue among certain chemical or rather ſympathetical phyſicians ſome years ago. A ſubject too whimſical to deſerve further notice.

TRANSPORTATION, the act of puniſhment, or more properly an alleviation or commutation of puniſhment, for criminals convicted of felony, who for the firſt offence, unleſs it be an extraordinary one, are generally tranſported to the Plantations, there to bear hard labour for a term of years; within which, if they return, they are executed without farther trial.

TRANSPORTATION *of Plants*. In ſending plants from one country to another, great cautions are neceſſary. The plants ſent from a hotter country to a colder, ſhould be always put on board in the ſpring of the year, that the heat of the ſeaſon may be advancing as they approach the colder climates; and, on the contrary, thoſe which are ſent from a colder country to a hotter ſhould be ſent in the beginning of winter. The beſt way of packing up plants for a voyage, if they be ſuch as will not bear keeping out of the earth, is to have boxes with handles, filling them with earth, and planting the roots as cloſe together as may be: the plants ſhould be ſet in theſe boxes three weeks before they are to be put on board, and in good weather they ſhould be ſet upon the deck, and in bad removed and covered with a tarpaulin.

If they are going from a hotter country to a colder one, they muſt have very little moiſture; if on the contrary, they are going from a colder to a warmer, they may be allowed water more largely, and being ſhaded from the heat of the ſun, they will come ſafe.

A great many plants, however, will live out of the earth a great while; as the ſedums, euphorbiums, ficoides, and other ſucculent ones. Theſe need no other care than the packing them up with moſs in a cloſe box; and there ſhould be a little hay put between them, to prevent them from wounding or bruiſing one another, and holes bored on the boxes to keep them from heating and putrifying. In this manner they will come ſafe from a voyage of two, or three, or even four or five months.

Several trees alſo will come ſafely in the ſame manner, taking them up at a ſeaſon when they have done growing, and packing them with moſs. Of this ſort are oranges, olives, capers, jaſmines, and pomegranate-trees. Theſe and many others are annually thus brought over from Italy; and, though they are three or four months in the paſſage, ſeldom miſcarry. The beſt way of ſending over ſeeds, is in their natural huſks, in a bag, or packed up in a gourd-ſhell, keeping them dry, and out of the way of vermin. *Miller's Gard. Dict.*

TRANSPOSITION, in algebra, the bringing any term of an equation over to the other ſide.

TRANSPOSITION, in grammar, a diſturbing or diſlocating of the words in a diſcourſe, or a changing of their natural order of conſtruction, to pleaſe the ear by rendering the contexture more eaſy, ſmooth, and harmonious. A tranſpoſition which renders the ſenſe perplexed, is vicious. The conſtitution of the ancient languages, being much more artful than that of the modern ones, allowed of much greater and more frequent tranſpoſitions. The Engliſh, French, &c. ſcarce ever allowed of them but in oratory and poetry, in which caſes they ſerve to give a force and energy to the diſcourſe or the verſe, and to prevent their languiſhing.

TRANSPOSITION, in muſic, is a changing of the notes of a piece of muſic, or the ſhifting a ſong from its former ſituation, to ſet it either higher or lower, or in another octave.

Of this there are two kinds: the firſt is with reſpect to the clef, the ſecond with reſpect to the key. Tranſpoſition, with reſpect to the clef, conſiſts in the changing the places or ſeats of the notes or letters among the lines and ſpaces, but ſo as that every note is ſet at the ſame letter. This is done either by removing the ſame clef to another line, or by uſing another clef, but with the ſame ſignature, by reaſon the piece is in the ſame key.

The practice is eaſy in either caſe. In the firſt you take the firſt note at the ſame diſtance, either above or below the clef-note, in its new poſition, as before, and all the reſt of the notes in the ſame relations or diſtances from one another, ſo that the notes are all ſet on lines and ſpaces of the ſame name. In the ſecond, or ſetting of the muſic to a different clef, it is to be obſerved the places of the three clef-notes are invariable in the ſcale, and are to one another in theſe relations, the mean a fifth above the baſs, and the treble a fifth above the mean. Now to tranſpoſe a new clef, for example, from the treble to the mean, wherever the new clef is ſet, we ſuppoſe it the ſame individual note in the ſame place of the ſcale, as if the piece were that part in the compoſition to which the new clef is generally appropriated, ſo that it may direct to the ſame notes we had before tranſpoſition. Now from the fixed relations of the three clefs in the ſcale, it will be eaſy to find the ſeat of the firſt tranſpoſed note, and then all the reſt are to be ſet at the ſame mutual diſtances they were at before. Suppoſe, for example, the firſt note of a ſong be *d*, a ſixth above the baſs clef; wherever that clef is placed, the firſt note muſt be a greater ſecond above it; becauſe a greater ſecond above the mean, is a greater ſixth above the baſs-clef, the relation between the two being a fifth: ſo that the firſt note will ſtill be the ſame individual note *d*. The uſe of this tranſpoſition is, that if a ſong be ſet with a certain clef in a certain poſition, the notes go far above or below the ſyſtem of five lines, they may, by the change of the place of the ſame clef in the particular ſyſtem, or by taking a new clef, be brought more within the compaſs of the lines.

Tranſpoſition from one key to another, is the changing of a key, or a ſetting all the notes of a ſong at different letters, and performing it conſequently in different places upon the inſtrument.

The deſign hereof is, that a ſong which being begun in one place is too high, too low, or otherwiſe inconvenient for a certain inſtrument, may be begun in another place, and from that carried on through all its juſt degrees. The clef and its poſitions here remain the ſame, and the change is of the notes themſelves, from one letter, and its line or ſpace, to another. In the former tranſpoſition the notes were expreſſed by the ſame letters, but both removed to different lines and ſpaces; in this the letters are unmoved, and the notes of the ſong tranſferred to or expreſſed by other letters, and conſequently ſet upon different lines and ſpaces, which therefore requires a different ſignature of the clef.

TRANSUBSTANTIATION, *Tranſubſtantiatio*, in theology, the converſion or change of the ſubſtance of the bread and wine in the euchariſt, into the body and blood of Jeſus Chriſt, which the Romiſh church hold it wrought by the conſecration of the prieſt. This is a main point in the Romiſh religion, and is rejected by the proteſtants, the former maintaining the tranſubſtantiation to be real, the latter only figurative; interpreting the text *hoc eſt corpus meum*, "This ſignifies my body:" but the council of Trent ſtood up ſtrenuouſly for the literal ſenſe of the verb *eſt*, and ſay expreſsly, that in tranſubſtantiation the body and blood of our Lord Jeſus Chriſt are truly, really, and ſubſtantially under the ſpecies of bread and wine. The controverſies about this point, are almoſt innumerable.

TRANSUMPTION, *Tranſumptio*, in the ſchools, a ſyllogiſm by conceſſion or agreement, uſed where a queſtion propoſed is transferred to another; with this condition, that the proof of this latter ſhould be admitted for a proof of the former.

TRANSVERSALIS, in anatomy, a name given to ſeveral muſcles, &c. in reſpect to their ſituation, progreſs, &c. as, 1. The tranſverſalis abdominis, a muſcle which lies under the obliqui, and ariſes from the cartilago xiphoides, from the extremities of the falſe ribs, from the tranſverſe apophyſis of the vertebræ of the loins, is fixed to the inner ſide of the ſpine of the ileum, and inſerted in the os pubis and the linea alba. This, with the obliqui, unites its tendons as it approaches the linea alba, and is the only muſcle that is cut in the operation of the bubonocele. It has a fine and thin membrane, that cloſes exactly its ring or hole through which the veſſels paſs. 2. Tranſverſalis colli, is ſaid to be a part of the longiſſimus dorſi. It ariſes from the os ſacrum, and from all the tranſverſe proceſſes of the vertebræ of the loins, back and neck, except the two firſt; and is inſerted by ſo many diſtinct tendons into all the ſuperior ſpines. It moves the whole ſpine obliquely backwards. 3. Tranſverſalis pedis placentini, comes from the bone of the metatarſus that ſuſtains the toe next the little toe, and paſſing acroſs the other bones, is inſerted into the os ſeſamoides of the toe. Its uſe is to bring all the toes cloſe to one another. 4. Tranſverſalis penis, one of the dilators of the urethra, ariſing from the tubercle of the os iſchium on each ſide, and inſerted into the poſterior part of the bulb of the urethra; however, theſe muſcles are not quite determinate and certain in their origin or inſertion, and ſometimes they are wholly wanting: when they act, they dilate the urethra in its poſterior part. 5. Tranſverſalis is alſo a name given to a ſuture of the cranium, becauſe of its traverſing or croſſing the face from one ſide to another.

TRANSVERSE, ſomething that goes acroſs another from corner to corner: thus bends and bars, in heraldry, are tranſverſe pieces or bearings: the diagonals of a parallelogram or a ſquare, are tranſverſe lines: lines which make interſections with perpendiculars, are alſo called oblique or tranſverſe lines.

TRANSVERSE AXIS, or DIAMETER, called alſo the firſt or principal axis.—The tranſverſe axis of an ellipſis is the longer axis, or that which traverſes it lengthwiſe, in contradiſtinction from the conjugate one.

TRAPEZIUM, in geometry, a plane figure contained under four unequal right lines. 1. Any three ſides of a trapezium taken together, are greater than the third. 2. The two diagonals of any trapezium, divide it into four proportional triangles. 3. If two ſides of a trapezium be parallel, the rectangle under the aggregate of the parallel ſides, and one half their diſtance is equal to that trapezium. 4. If a parallelogram circumſcribes a trapezium, ſo that one of the ſides of the parallelogram be parallel to a diagonal of the trapezium, that parallelogram will be the double of the trapezium. 5. If any trapezium has two of its oppoſite angles, each a right-angle, and a diagonal be drawn joining theſe angles; and if from the other two angles be drawn two perpendiculars to that diagonal, the diſtances from the feet of theſe perpendiculars to thoſe right-angles, reſpectively taken, will be equal. 6. If the ſides of a trapezium be each biſſected, and the points of biſſection be joined by four right lines, theſe lines will form a parallelogram, which will be one half of the trapezium. 7. If the diagonals of a trapezium be biſſected, and a right line joins theſe points, the aggregate of the ſquares of the ſides is equal to the aggregate of the ſquares of the diagonals, together with four times of the ſquare of the right line joining the point of biſſection. 8. In any trapezium, the aggregate of the diagonals is leſs than the aggregate of four right lines drawn from any point, except the interſection of the diagonals, within the figure.

TRAPEZIUS, in anatomy. See CUCULARIS.

TRAPEZOID, is a ſolid irregular figure, having four ſides not parallel to one another.

TRAVERSE, or TRANSVERSE, in general, denotes ſomething that goes athwart another; that is, croſſes and cuts it obliquely.

Hence, to traverſe a piece of ordnance, among gunners, ſignifies to turn or point it which way one pleaſes, upon the platform.

In fortification, traverſe denotes a trench with a little parapet, or bank of earth, thrown perpendicularly acroſs the moat, or other work, to prevent the enemy's cannon

from raking it. Theſe traverſes may be from twelve to eighteen feet, in order to be cannon proof, and their height about ſix or ſeven feet, or more, if the place be expoſed to any eminence. And to preſerve a communication, a paſſage of about five or ſix feet wide muſt be left at one end of the traverſe.

If any part of a work, thus ſhut in by one or more traverſes, is likely to be defended by the muſketry, it will be proper to add to the traverſes one or more foot-banks within the defence, for the troops to mount on, when they want to fire over the traverſe.

TRAVERSE, in navigation, is when a ſhip, upon the ſhifting of winds, ſails upon ſeveral courſes, in any given ſpace of time. To reſolve a traverſe, is ſo to order and compound the ſeveral courſes and diſtances obtained by the log and compaſs, that the mariner may know, at all times, the place the ſhip is in, and be able to determine how far, and upon what courſe he muſt ſail to gain his intended port.

Exam. Suppoſe a ſhip, in the latitude of 4 deg. 10 min. north, 3° 39′ E. long. ſails S. 11° W. 91 miles, S. W. 120 miles, W. N. W. 130 miles, S. E. 135 miles, S. E. by E. 130 miles, and S. W. by S. 150 miles; required the direct courſe and diſtance ſailed, and the latitude and longitude the ſhip is in?

Geometrically. Draw the meridian line $p\,x$ (plate CXXXI. *fig.* 9.) and make the angle $q\,p\,2$ equal to 11° 15′ = 1 point, and draw the right-line $q\,p$, making it equal to 88 miles, the firſt diſtance ſailed, and let fall the perpendicular $q\,2$; then will q be the place of the ſhip, $p\,2$ the difference of latitude, and $q\,2$ the departure belonging to the firſt courſe: And after the ſame manner muſt the triangles $q\,3\,r$, $r\,s\,4$, $4\,t\,5$, $5\,u\,6$, and $6\,7\,w$, be projected; then will w be the place of the ſhip at the end of her ſailing, $p\,x$ the difference of latitude, $w\,x$ the departure, the angle $x\,p\,w$ her direct courſe from her firſt to her laſt ſtation, and $p\,w$ her direct diſtance; which may be all meaſured by the inſtructions given under the article *Plane* SAILING.

Arithmetically. The arithmetical ſolution of this problem depends entirely on the firſt and fourth caſes of *Plane* SAILING; for firſt the correſponding difference of latitude and departure muſt be found to each courſe and diſtance, as in the firſt caſe, and placed in a table according to their ſeveral directions: That is, when the ſhip ſails to the northward, the difference of latitude muſt be placed in the north column, but, when to the ſouthward, in the ſouth column; and the departure, if ſhe ſails to the weſtward, in the weſt column, but if to the eaſtward, in the eaſt column. Then will the totals of the ſeveral columns ſhew the northings, ſouthings, eaſtings, and weſtings the ſhip has made. And, conſequently, if the ſouthings exceed the northings, the ſhip will be to the ſouthward of her firſt ſtation, and juſt as much as is the exceſs, and *vice verſa*; in like manner, if the eaſtings exceed the weſtings, the ſhip will be to the eaſtward of her firſt meridian, but, if the contrary, to the weſtward. Then we ſhall have the whole difference of latitude and departure from the meridian given, to find the courſe and diſtance as in the fourth caſe. See the following table:

Courſes.	Diſtances.	Diff. of Lat.		Departure.	
		Northings.	Southings.	Eaſtings.	Weſtings.
South 11° weſt	91		89,3		17,2
South-weſt	120		84,8		84,8
Weſt-north-weſt	130	49,8			120,1
South-eaſt	135		95,4	95,4	
South-eaſt by eaſt	130		73,3	108,0	
South-weſt by S.	150		124,7		83,4
		49,8	467,5	203,4	305,5
			49,8		203,4
		Diff. Lat. 417,7		Depart. 102,1.	

Hence, it appears, that the ſhip is 417,7 miles to the ſouthward of her firſt ſtation, and 102,1 miles to the weſtward of her firſt meridian; whence we may, by the fourth caſe of plane ſailing, find her direct courſe and diſtance, as follows:

1. As the difference of latitude $p\,x$ = 417,7 = 2.6208645
Is to the radius —— —— = 90d. 00m. = 10.0000000
So is the departure $w\,x$ —— — = 102,1 = 2.0090257

To the T. of the courſe or angle $w\,p\,x$ = 13d. 44m. = —— —— —— —— —— } 9.3881612

Which is ſouth 13d. 44m. weſterly, or ſo nething more than ſouth by weſt, becauſe the difference of latitude is ſoutherly, and the departure weſterly.

2. As the ſine of the courſe —- = 13d. 44m = 9,3760034
Is to the departure —— —— = —- 102,1 = 2,0090257
So is the radius —— —— = 90d. 00m. = 10,0000000

To the diſtance —— —— = 429,6 —— = 2.6330223

And, becauſe the difference of latitude exceeds the latitude ſailed from, d. m.
Therefore, from the diff. of latitude = 417,7 = 6: 57,7
Take the latitude ſailed from —— —— — = 4: 10 N.

Remains the latitude the ſhip is in —— — = 2: 47,7 S.

And, becauſe the difference of long. is weſterly, therefore, d. m.
From the longitude ſailed from —— —— = 3: 39 eaſt.
Take the difference of longitude = 102,1 = 1: 42,1 weſt.

Remains the longitude the ſhip is in —— = 1: 47,9 eaſt

Hence it appears, that the ſhip is arrived in the latitude of 2d. 47,7m. = 2d. 47m. 42ſ. ſouth, and 1d. 47,9m. = 1d. 47m. 54ſ. eaſt longitude; her direct courſe from her firſt to her laſt ſtation being ſouth, 13d. 44m. weſterly, diſtant 429,6 miles.

TRAVERSE, in law, denotes the denial of ſome matter of fact alledged to be done in a declaration, or pleadings: upon which the other ſide coming and maintaining that it was done, iſſue is joined for the cauſe to proceed to trial.

TRAVERSE *of an Indictment*, or *Preſentment*, is the contradicting or denying ſome chief point of it, and taking iſſue thereon.

TRAVERSE *of an Office*, is the proving that an inquiſition made by lands or goods, is defective and untruly made.

TRAVERSE is ſometimes alſo uſed, in heraldry, for a partition of an eſcutcheon, which is blazoned parti per pale traverſe, argent and gules.

TRAVESTY, or TRAVESTI, a French term, derived from the verb *traveſtir*, to diſguiſe one's ſelf, or to appear in maſquerade: and hence, traveſty is applied to the diſfiguring of an author, or the tranſlating him into a ſtyle and manner different from his own, by which means it becomes difficult to know him.

TRAUMATICS, the ſame with vulnerary medicines. See VULNERARY.

TREACLE, *Theriaca*, in pharmacy. See the article THERIACA.

Some alſo give the name treacle to melaſſes; and in this ſenſe it is that Dr. Shaw, in his Eſſay on Diſtillery, has endeavoured to bring into uſe ſeveral ſorts of treacles, which might be made at home, and would ſerve very conveniently for the diſtillation of ſpirits, or the making of potable liquors. Theſe are the inſpiſſated juices or decoctions of vegetables: ſuch as the ſweet juice of the birch, or ſycamore, procured by tapping or piercing the trees in ſpring, and the common wort made from malt, or from other vegetable ſubſtances treated in the ſame manner. Theſe liquors are ſeverally to be boiled down in a copper till they begin to inſpiſſate, and then to be poured into a balneum mariæ, when the remainder of the evaporation may be finiſhed without burning the inſpiſſated juices: thus prepared it may be at any time reduced to the ſtate of wort, only by adding a ſufficient quantity of warm water.

TREASON, in general, ſignifies betraying; but is more particularly uſed for the act or crime of infidelity to one's lawful ſovereign.

Treaſon is divided, by lawyers, into high treaſon and petty treaſon. The firſt of theſe is an offence committed againſt the ſecurity of the king or kingdom; as to compaſs,

or imagine, the death of the king, queen, or their eldeſt ſon and heir; or in caſe a perſon does violate or deflower the king's wife, or his eldeſt daughter unmarried, or the wife of the king's eldeſt ſon; or if he levy war againſt the king within his kingdom, or adhere to his enemies, give them aid or comfort within the realm, or elſewhere; or if he counterfeit the king's great or privy ſeal, or his money, or bring falſe money into the kingdom, like to what we have here, and utter the ſame; if he kill the chancellor, treaſurer, juſtices of either bench, juſtices of aſſize, or of oyer and terminer, ſitting in judgment and repreſenting the perſon of the king, in the execution of his office: all theſe caſes are deemed treaſon by 25 Ed. III. c. 2. which ſtatute is made the only ſtandard of high treaſon; and 1 Mary c. 1. takes away the power of the king and parliament to adjudge any thing elſe to be high-treaſon but what is declared to be ſuch therein: it is true, temporary ſtatutes of late times enacted, have made ſome other offences treaſon, as relating to papiſts and the proteſtant ſucceſſion.

It has been held, that words only, where they are deliberate, and ſhew a direct purpoſe againſt the king's life, will amount to an overt-act of compaſſing or imagining his death, and are high-treaſon: for words are the moſt natural way of expreſſing the imagination of the heart, and may be good evidence of it: not only words of perſuaſion to kill the king, but ſuch as are ſpoken in order to draw away the affections of his people, and to ſtir them up againſt him, are tending to the king's death, and therefore treaſon. Likewiſe where a perſon intends by force to preſcribe laws to the king, or to reſtrain him of his royal power, it has been adjudged an intention to deprive him of his crown and life; and in the eye of the law, every rebellion is a treaſonable plot againſt the life of the king, for a rebel would not ſuffer that king to live and reign, who would puniſh his offence.

As to make a crime treaſon, there muſt be always ſome overt-act; a bare conſpiracy, or compaſſing to levy war, is no ſuch act, unleſs it be really levied; in which caſe the conſpirators are all traitors, although they are not in arms: perſons that raiſe forces for any public end or purpoſe, or who make an inſurrection on any account, are ſaid to levy war againſt the king, though perhaps without a direct deſign againſt his perſon; and it extends to the caſe where great numbers forcibly endeavour to remove certain perſons from the king, &c. The adhering to the king's enemies, is taken to be an adherence againſt him, and even out of the realm it is treaſon: and it is ſaid, that cruiſing in a ſhip of war with an intent to deſtroy the king's ſhips, though no act of hoſtility be committed, is an overt-act of adhering, comforting and aiding.

All trials for high-treaſon are to be according to the courſe of the common law; and perſons indicted for this crime, are to have a copy of the indictment five days before their trial, that they may have ſufficient time to adviſe with council; they ſhall likewiſe be permitted to make a full defence by their council learned in the law, and by lawful witneſſes, &c. And in this caſe there muſt be two evidences to the ſame overt-act, or to two acts of the ſame treaſon, produced face to face againſt them. It is alſo ſaid, where a perſon is convicted of treaſon, the omiſſion of any neceſſary part of the judgment will be held to error, on which he may reverſe the attainder; as the judgment is ſeverer, and more formidable, in caſe of high-treaſon than for any other crime whatever; ſince the offender is to be hanged, drawn, and quartered, and alſo forfeit his lands and goods to the king.

Petty treaſon, is where a ſervant kills his maſter, a wife her huſband, or a ſecular or religious perſon kills his prelate or ſuperior, to whom he owes faith and obedience, and aiders and abettors, as well as procurers, are within the act. However, ſo ſtrictly is the ſtatute conſtrued, that no caſe not expreſsly mentioned therein is puniſhable by it: hence if a ſon kill his father, he ſhall not be tried for petty treaſon, except he ſerved his father for wages, in which caſe he is to be indicted under the name of a ſervant.

Petty treaſon implies the higheſt degree of murder, and occaſions the forfeiture of lands by eſcheat to the lord of the fee: and the further puniſhment of the criminal is to be hanged, drawn, and quartered for it, and a woman burnt.

TREASURE, in general, denotes a ſtore or ſtock of money in reſerve.

TREASURE-TROVE, in law, is where any treaſure is found buried in the earth, but not lying on the ground, and no man knows to whom it belongs: this, in England, belongs to the king, and to conceal it is puniſhable by fine and impriſonment.

TREASURER, an officer to whom the treaſure of a prince, or corporation, is committed to be kept, and duly diſpoſed of in payment of officers, and other expences.

Lord high TREASURER *of England*, is the third great officer of the crown, under whoſe charge and government is all the king's revenue kept in the Exchequer.

He receives the office by the delivery of a white ſtaff to him from the king, and holds it during the king's pleaſure; anciently he received it by delivery of the golden keys of the treaſury. He has the check of all the officers any way employed in collecting impoſts, cuſtoms, tributes, or other revenues of the crown. He has the gift of all the cuſtomers, comptrollers, and ſearchers of places in all the ports of London, and the nomination of the eſcheators in every county.

He alone, or others in commiſſion with him, letteth leaſes of all the crown lands, gives warrants to certain perſons of quality to have their wine cuſtom free, &c.

TREASURER *of the Houſhold*, is an officer who, in the abſence of the lord ſteward, has power with the comptroller and other officers of the Green-cloth, and the ſteward of the Marſhalſea, to hear and determine treaſons, felonies, and other crimes committed within the king's palace.

TREASURER *of the Navy*, is an officer who receives money out of the Exchequer, by warrant from the lord high treaſurer, or the lords commiſſioners executing that place, and pays all charges of the navy by warrant from the principal officers of the navy.

TREASURY, the place wherein the revenues of a prince are received, preſerved, and diſburſed.

In England, the Treaſury is part of the Exchequer, by ſome called the lower Exchequer.

Lords of the TREASURY.—In lieu of one ſingle director and adminiſtrator of his majeſty's revenues under the title of lord high treaſurer, it is frequently thought proper to put that office in commiſſion, that is, to appoint ſeveral perſons to diſcharge it with equal authority, under the title of lords commiſſioners of the Treaſury.

TREATISE, *Tractatus*, a ſet diſcourſe in writing on any ſubject. A treatiſe is ſuppoſed more expreſs, formal, and methodical than an eſſay, but leſs ſo than a ſyſtem.

TREATY, a covenant between two or more nations; or the ſeveral articles or conditions ſtipulated and agreed upon between ſovereign powers.

TREBLE, in muſic, the higheſt or acuteſt of the four parts in ſymphony, or that which is heard the cleareſt and ſhrilleſt in a concert.

TREE, *Arbor*, the firſt and largeſt of the vegetable kind, conſiſting of a ſingle trunk, out of which ſpring forth branches and leaves.

Standard-trees are ſuch as naturally riſe to a great height, and are not topped. For the choice of trees of this kind to be tranſplanted out of a nurſery, Quintiney recommends us to ſuch as are ſtraight, ſix feet high at leaſt, and five or ſix inches thick at bottom, and three or four at top; the bark pretty ſmooth and ſhining, as a token of their youth, and of the good ſoil they grew in.

Dwarf-trees are ſuch as are kept low, and never ſuffered to have above half a foot or ſtem.

Fruit TREES. See the article FRUIT.

Heat is ſo eſſential to the growth of trees, that we ſee them grow larger and ſmaller in a ſort of gradation, as the climates in which they ſtand are more or leſs hot.

The hotteſt countries yield in general the largeſt and talleſt trees, and thoſe alſo in much greater beauty and variety than the colder do; and even thoſe plants which are common to both arrive at a much greater bulk in the ſouthern, than in the northern climates; nay, there are ſome regions ſo bleak and chill, that they raiſe no vegetables at all to any conſiderable height. Greenland, Iceland, and the like places, afford no trees at all; and what ſhrubs grow in them are always little and low. In the warmer climates, where trees grow to a moderate ſize, any accidental diminution of the common heat is found very greatly to impede vegetation; and, even in England, the cold ſummers we ſometimes have, give us an evident proof of this; for though the corn and low plants have ſucceeded well enough, and gooſeberries, currants, raſberries and other low ſhrubs, have brought forth fruit in ſufficient plenty, yet the production of taller trees has been found very much hurt; and walnuts, apples, and pears, have been very ſcarce among us.

Heat is heat, be it from what cauſe it will, and acts as well upon vegetation one way as another. Thus the heat of dung, and the artificial heat of coal fires in ſtoves, is found to ſupply the place of the ſun.

Great numbers of the Indian trees in their native ſoil flower twice in a year, and ſome flower and bear ripe fruit all the year round; and it is obſerved of theſe laſt, that they are at once the moſt frequent and moſt uſeful to the inhabitants; their fruit, which hang always on them in readineſs, containing cool juices, which are good in fevers, and other of the common diſeaſes of that hot country.

Plantations of uſeful trees might be made to very great advantage in many places in every country, and the country greatly enriched by it, while the public would be alſo benefited by it, ſince it would raiſe a continual ſupply of timber uſed in ſhip-building, and on other public as well as private occaſions.

We have, in many places, heaths, and other barren and uncultivated lands, of very great extent; and how great an advantage would it be to the public, to bring theſe to be truly valuable? Many, if not all of theſe heaths, would be found on trial capable of producing trees; and ſome of them are truly the remains of deſtroyed foreſts; and, though the profits to be reaped from the planting theſe would come late, yet the expence of doing it would be very trifling in compariſon of that profit, and the means eaſy.

The authors who have given rules for planting, having employed themſelves only about ſmall ſpots of ground, the eſtabliſhing orchards, or parks, are by no means to be ſuppoſed proper guides in attempts of this kind; and Monſieur de Buffon, who had a great opinion of the knowledge of our Evelyn and Miller, who ſeem to ſpeak of every thing from their own experience, found, when he ſet about large plantations, that their opinions and rules were erroneous; and was obliged to have recourſe to experiments only; which he varied a thouſand ways: and, though many of them proved unſucceſsful, yet they all gave hints towards others, by which the attempt might afterwards be brought to ſucceed.

This ſagacious enquirer into the operations of nature in the growth of vegetables, having ſet apart a conſiderable quantity of land for the trial, and procured a number of young trees, firſt divided the whole quantity into a number of ſmall ſquares, and, having made a plan of it, examined the nature, depth, and other circumſtances of the ſoil in each, and minuted the whole down on a proper part of the plan: that himſelf or whoever ſucceeded him might judge, from the different growths of a number of trees planted in the ſame ſtate in the different ſoils, the different advantages and diſadvantages of every circumſtance in the depth and nature of the ground, in regard to the growth of uſeful trees. Different numbers of labourers were employed about different ſpots of this ground, and the acorns for the young growth planted at different ſeaſons; but the reſult in general was, that what ſhould ſeem the beſt methods ſucceeded the worſt; and thoſe pieces where many labourers were employed, and the acorns planted before winter, were much thinner of young oaks, than thoſe where the leaſt labour had been beſtowed upon the ground, and where the acorns had been planted in the ſpring; but thoſe places which ſucceeded beſt from the ſowing, were thoſe which had the acorns planted in holes made by a pickax, without any preceding culture of the ground. And thoſe where the acorns had only been laid upon the earth, under the graſs, afforded a great number of vigorous young trees, though the greater part had been carried away by birds, and other devouring animals. Thoſe ſpots of ground where the acorns were ſet ſix inches deep, were much worſe furniſhed with young ſhoots, than thoſe where they had been buried but at an inch deep; and in ſome places where they were buried at a foot deep, not one ſhoot appeared, though in others where they had been buried at nine inches there were many.

Thoſe acorns which had been ſteeped for eight or nine days in wine lees, and in the water of the common ſewers, appeared out of the ground much earlier than thoſe which were put in without this previous management.

But the moſt ſucceſsful of all the trials was that of planting in the ſpring ſuch acorns as had been ſown together in another place, and had time to ſhoot there; of theſe ſcarce any failed, and the plantation was perfectly flouriſhing, though the growth of theſe young ſhoots was not ſo quick and vigorous as thoſe of the acorns which had remained, when firſt ſown; which was probably owing to the injury the tender radicles received in tranſplanting.

Thus ſucceeded the experiments by ſowing, while, of thoſe made by planting young trees, ſuch as had been brought out of woods, and places under covert, ſucceeded much worſe than thoſe which had grown in more expoſed places.

The young trees of the ſeveral parts of the plantation kept on their growth in the manner they had begun to ſhoot, thoſe of the more laboured parts continuing more weak, and lower than thoſe of the leſs laboured.

Thus were a number of neceſſary experiments carefully tried, and the reſult of the whole was, that to make a plantation of oaks, on a ſoil of the common clayey or loamy kind, the moſt ſucceſsful method is this: the acorns muſt be preſerved during the winter in the earth in this manner; let there be made a bed of earth ſix inches deep, on this place a layer of acorns two inches deep, over theſe lay a bed of another half foot of earth, over that another layer of acorns, and ſo on ſucceſſively, till as many are employed as there will be occaſion for; the whole is then to be covered with a foot depth of earth, to preſerve all from the froſt. In the beginning of March, theſe beds are to be opened, and the acorns which will by that time have ſhot out, and are then in reality ſo many young oaks, are to be planted out at a foot diſtance each, and the ſucceſs of a plantation of this kind need not be feared. This is a manner of planting that is done at a ſmall expence, and even that might be in a great meaſure ſpared, were it not for the birds and other devouring animals; ſince, could the acorns be defended from theſe, they might be only laid on the ſurface of the ground under the graſs in autumn, and they would infallibly ſhew themſelves in ſo many young oaks the ſucceeding ſpring.

It is eaſy to continue the carrying the acorns, when taken out of their winter's bed, to the place where they are to be planted, without doing them much injury; and the ſmall ſtop the tranſplanting puts to their growth, is in reality rather an advantage than an injury; ſince it only retards the young ſhoots for about three weeks, or leſs than that: and by that means ſecures them from the few cold mornings that may be expected about the time of their natural appearance.

For the planting, pruning, felling, grafting, &c. of trees, ſee the article PLANTING, PRUNING.

TREFOIL, *Trifolium*, in botany, a genus of plants, the flower of which has a tubulous permanent empalement of one leaf: it is of the butterfly kind, drying in the empalement. The ſtandard is reflexed, the wings are ſhorter than the ſtandard, and the keel is ſhorter than the wings; it has ten ſtamina, nine are joined, and one is ſeparate, terminated by ſingle ſummits; and an almoſt

oval germen ſupporting an awl-ſhaped ſtyle, crowned by a ſingle ſtigma. The germen afterward becomes a ſhort pod with one valve, containing a few roundiſh ſeeds.

Mr. Miller enumerates twelve different ſpecies of trefoil, the firſt of which is well known in England by the name of red clover; and the manner of cultivating this plant has been already deſcribed under the article CLOVER.

The ſecond ſort, namely, the white Dutch clover, grows naturally in moſt of the paſtures in England, and is generally known among the country people by the name of white honey-ſuckle.

This is an abiding plant, whoſe branches trail upon the ground, and ſend out roots from every joint, ſo that it thickens and makes the cloſeſt ſward of any of the ſown graſſes; and it is the ſweeteſt feed for all ſorts of cattle yet known: therefore when land is deſigned to be laid down for paſture, with intent to continue ſo, it ſhould be ſown with the ſeeds of this plant. The uſual allowance of this ſeed is eight pounds to one acre of land; but this ſhould never be ſown with corn, for if there is a crop of corn, the graſs will be ſo weak under it, as to be ſcarce worth ſtanding; but ſuch is the covetouſneſs of moſt farmers, that they will not be prevailed on to alter their old cuſtom of laying down their grounds with a crop of corn, though they loſe twice the value of their corn by the poorneſs of the graſs, which will never come to a good ſward, and one whole ſeaſon is alſo loſt; for if this ſeed is ſown in the ſpring without corn, there will be a crop of hay to mow by the middle, or latter end of July, and a much better after-feed for cattle the following autumn and winter, than the graſs which is ſown with corn will produce the ſecond year. The ſeed of this ſort may alſo be ſown in autumn, and this autumnal ſowing, if the ſeeds grow kindly, will afford a good early crop of hay the following ſpring; and if, after the hay is taken off the land, the ground be well rolled, it will cauſe the clover to mat cloſe upon the ground, and become a thick ſward.

The ſeeds of this white Dutch clover is annually imported from Flanders, by way of Holland, whence it received the name of Dutch clover; not that it is more a native of that country than of this, for it is very common in moiſt paſtures, in every county in England: but the ſeeds were never collected for ſowing in this country till of late years; nor are there many perſons here, even now, who ſave this ſeed, though it may be done if the ſame method, as is practiſed for the red clover, be taken with this ſort; it ſhould therefore be recommended to every farmer, who is deſirous of improving his land, to ſow carefully an acre or two of this white clover for ſeed, which will ſave him the expence of buying for ſome years, when the price is great; and there will be a ſure market for any quantity he may have to ſpare.

The third ſort, namely hop-clover, called by ſome yellow meadow trefoil, grows naturally among the graſs in the upland paſtures of this country; but the ſeeds are frequently ſold in the ſhops, and are by many mixed with the other ſorts of clover and graſs-ſeeds, for laying down ground to paſture. This plant grows with upright branching ſtalks about a foot high, garniſhed with trifoliate leaves, whoſe lobes are oblong and heart-ſhaped, but reverſed, the narrow point joining the foot-ſtalks. The flowers, which are yellow, grow from the wings of the ſtalk, upon long foot-ſtalks, collected into oval imbricated heads, having naked empalements lying over each other like ſcales, ſomewhat like the flowers of hops, from whence the plant had the name of hop-clover. But there are two ſorts of this clover, which grow naturally in England. The other is a much ſmaller plant than this, and generally known by the name of none-ſuch, or yellow hop-treſoil.

The hop-clover is ſtrongly recommended by the following circumſtances. 1. It not only grows, but flouriſhes on the moſt barren ſands, and therefore muſt be a very proper graſs to cultivate on ſuch unfertile ſoils, where any other graſs that is worth notice will not grow at all. 2. It is not apt to ſwell cattle, as the red clover does. 3. In good ground it will continue long, and bear a very good ſeed or crop, as Mr. Tull, though prejudiced againſt clovers, confeſſes; and, by its flouriſhing both on ſands and clay, which have not been ploughed for many years, it ſeems likely to continue long in any ſoil.

The fifth ſort grows naturally on chalky lands in many parts of England; and in ſome countries the ſeed is ſown after the ſame manner as the common red clover, eſpecially on chalky ground, where it will thrive, and produce a better crop than clover. The ſtalks of this are hairy, and grow erect to the height of two feet or more, garniſhed with trifoliate leaves, ſtanding upon long foot-ſtalks, whoſe lobes are longer than thoſe of the red-clover, and have no marks of white; they are of a yellowiſh green colour, and are covered with ſoft hairs. The flowers grow in oval ſpikes at the end of the branches; they are of a pale copper colour; their petals are long and tubulous, but the brim is divided into two lips, as the other ſorts.

This is known by the title of trefoil, in the places where it is cultivated; but the ſeedſmen ſell the hop-clover by that name, ſo they make no diſtinction between this, the hop-clover, and none-ſuch; therefore, by which of theſe three titles the ſeeds are bought, they prove the ſame.

This ſort of trefoil is much cultivated in that part of Eſſex which borders on Cambridgeſhire.

The ſixth ſort grows naturally in Spain and Italy; this has upright ſtalks near two feet high, which are hairy, garniſhed with trifoliate leaves, having roundiſh lobes, which are ſawed at their points. The flowers are produced at the top of the ſtalk in long, obtuſe, hairy ſpikes, of a bright red colour, ſo make a pretty appearance during their continuance. It is an annual plant, ſo is not proper for ſowing as fodder.

The ſeventh ſort is an annual plant, which grows naturally in the ſouth of France and Italy; it riſes with a ſtrong ſmooth ſtalk near three feet high, garniſhed with trifoliate leaves, whoſe lobes are two inches and a half long, and near a quarter broad, ſtanding upon long foot-ſtalks, which are embraced by ſtipulæ or ſheaths their whole length. The flowers are produced at the top of the ſtalks in very long ſpikes; they are of a beautiful red colour, ſo make a fine appearance. It flowers in July, and the ſeeds ripen in autumn.

The eighth ſort grows naturally in Spain and Italy; this riſes with a ſlender ſtiff ſtalk near two feet high, garniſhed with trifoliate leaves, whoſe lobes are very narrow and hairy. The flowers are produced at the top of the ſtalks in oblong conical ſpikes; the indentures of their empalements end in long briſtly hairs, which are almoſt equal in length; the ſpikes are hairy, and the flowers of a pale red colour.

The ninth ſort is the common hare's foot treſoil, which grows naturally upon dry gravelly land in moſt parts of England, and is a ſure indication of the ſterility of the ſoil, for it is rarely ſeen upon good ground. This plant is ſeldom eat by cattle, ſo is unfit for paſture, and is only mentioned here becauſe it is ſometimes uſed in medicine; it is an annual plant, whoſe root decays ſoon after it has perfected ſeeds.

The tenth ſort grows naturally on arable land in many parts of England; this has trailing ſtalks, which put out roots at their joints. The leaves ſtand upon long ſlender foot-ſtalks; the lobes are roundiſh, and ſawed on their edges; the flowers are collected in roundiſh heads, ſtanding upon ſlender foot-ſtalks, which riſe from the wings of the ſtalks; theſe have bladdery empalements, which terminate in two teeth. When theſe lie on the ground, their globular heads, having a little bluſh of red on their upper ſide toward the ſun, and the other part being white, have a great reſemblance of ſtrawberries, and from thence it was called ſtrawberry trefoil.

Theſe ſorts are preſerved in botanic gardens for variety; they are eaſily propagated by ſeeds, which may be ſown on an open bed of ground, either in autumn or ſpring.

The plants which come up in autumn, will grow much larger, and flower earlier in the ſummer than thoſe which are ſown in the ſpring, ſo from thoſe good ſeeds may be always obtained, whereas the others ſometimes miſcarry.

When the plants come up, they require no other care than to keep them clean from weeds, and thin them where they are too close.

The eleventh sort is the common melilot, which is used in medicine, and has been already described under the article MELILOT, which see.

The twelfth sort grows naturally in Bohemia and Austria, but has been long cultivated in England as a medicinal plant, though at present it is rarely used; it is annual. The stalks are large, hollow, and channelled; they rise about a foot high, garnished with trifoliate leaves, whose lobes are oval, and slightly sawed on their edges, standing upon pretty long foot-stalks. The flowers are collected in oblong spikes, which stand upon very long foot-stalks, springing from the wings of the stalk at every joint; they are of a pale blue colour shaped like those of the common melilot; these appear in June and July, and are succeeded by small yellow seeds, of a kidney shape, two or three being included in each short pod. The whole plant has a very strong scent like that of fenugreek, and perishes soon after the seeds are ripe. *Miller's Gard. Dict.*

TREMOR, or TREMBLING *of the Joints*, in medicine, is an involuntary shaking, chiefly of the hands and head, sometimes of the feet, and sometimes of the tongue and heart. It is a disorder which frequently attacks persons advanced in years, and sometimes the younger sort. It seems to arise from a defect of spirits, sometimes from terror, or other violent passion, and sometimes from a plethora. Too much drinking of coffee also produces a tremor in some persons, as too plentiful drinking and surfeits will in others.

Tremors are often dangerous, as being apt to degenerate into other nervous distempers; as spasms, the palsy, lethargy, apoplexy, &c.

In the cure, those things should be avoided that promote the disease, and the patient should drink balm or sage-tea, or a diet-drink made of China-root. Peruvian bark may also be taken, in an infusion of balm or sage, or succinated spirit of hart's-horn, twice or thrice in a day; and in the evening an antispasmodic powder may be taken, especially if the patient is hot, or uses much wine. Outwardly, the neck and spine of the back may be rubbed with the spirits of ants, earth-worms, and sal ammoniac, mixed together; a fourth part of the volatile spirits will be sufficient, or opodeldoc may be used in their stead. If the patient is plethoric, bleeding is useful; and in old persons, a draught of generous wine at meals: pediluvia, hot-baths, and mineral-waters, may also be used, but with caution.

As to the medicine commonly used in tremors and other nervous distempers, under the name of palsy-drops, it is no other than compound spirit of lavender; the most successful way of using which is, by taking thirty or forty drops twice or thrice a day, dropped on loaf-sugar or a little bread. It is supposed that by this way the most spirituous and efficacious parts make their way directly by the nerves of the palate, &c. without undergoing the course of the circulation, as it is said to do when taken in a liquid vehicle.

TRENCHES, in fortification, are ditches cut by the besiegers, that they may approach more securely to the place attacked: whence they are also called lines of approach. The tail of the trench is the place where it was begun, and its head is the place where it ends.

The trenches are usually opened, or begun, in the night-time; sometimes within musket-shot, and sometimes within half or whole cannon-shot of the place.

They are carried on in winding-lines, nearly parallel to the works of the fortress, so as not to be in the view of the enemy, nor exposed to the enemy's shot.

The workmen employed in the trenches are always supported by a number of troops, to defend them against the sallies of the besieged: the pioneers sometimes work on their knees, and are usually covered with mantlets or sauciſſons; and the men who support them lie flat on their faces, in order to avoid the enemy's shot.

TREPAN, *terebra*, *modiolus*, &c. in surgery, an instrument used in trepanning.

TREPANNING, in surgery, a perforation, or opening, made in the bones of the cranium.

This operation was performed by the antients, not only in fractures and depressions of the cranium, but also in those other obstinate disorders of the head and brain, which could not be relieved by internal medicines and the use of issues upon the coronal suture; but the modern surgeons never use the trepan for internal disorders of the head, though they seldom neglect it in fractures and depressions of the cranium.

The trepan is therefore useful not only in these cases, to elevate the depressed parts of a fractured bone in the cranium, but also to discharge the extravasated blood through an aperture made by this instrument.

The less time there is lost the better before the application of the trepan, but the operation itself must be conducted slowly and carefully; for it is extremely difficult, if not impossible, to take out a piece of the cranium by this instrument without injuring the subjacent dura mater, to which it is most intimately attached. For this reason Heister is induced to condemn the advice of those who direct to trepan the cranium immediately upon every slight disorder of it: he therefore advises first to try the use of other remedies, both external and internal, rather than immediately subject the patient to the trepan, before it is absolutely necessary. In general, the place where the fissure appears will be the most convenient to apply the trepan, if nothing indicates the contrary: but in fractures it will be proper to trepan a little below the injured part, that the extravasated blood may be more easily discharged. It must be next observed, that there are several places in the cranium which ought not to be in any case trepanned; such as, 1. upon the sutures, especially the sagittal suture; yet in cases of urgent necessity, the trepan may be used upon the coronal sutures, and sometimes upon the others. 2. It is equally dangerous to trepan the cranium in the middle of the os frontis, especially in that part which forms the fontanel. 3. The trepan must not be used upon any of the sinuses of the os frontis. 4. Nor ought it to be used where any large vein or artery spreads itself. 5. If the fractured part of the bone upon which you fix the trepan is loose, or carious, you might then injure the brain by this instrument. 6. It will be improper to trepan in the lower parts, or basis, of the cranium, which are invested with muscles. 7. Lastly, it will be improper to trepan upon the cruciform eminence of the os occipitale. Notwithstanding these cautions, if a violent fracture should happen in or near these parts, you should trepan as near them as possible; and if the fracture has passed across the sutures, you must trepan within a finger's breadth of the suture on each side. Sometimes it is impossible to discover the particular part of the cranium which is injured, the patient in the mean time being affected with the most dangerous and urgent symptoms. In these cases it will be necessary to trepan first on the right side, then on the left, afterwards upon the forehead, and lastly upon the occiput, and so round till you meet with the seat of the disorder.

After having pitched upon the part to be trepanned, your next business is to shave the scalp, and make an incision through the integuments to lay bare the cranium, except it be done already by the wound.

The incision of the integuments may be made in the form of a cross, or of the letters X, V, or T, large enough to admit the crown of the trepan upon the bone. The wound may be enlarged, and the hæmorrhage stopped, after the integuments and periosteum are separated and elevated from the cranium, by inserting a large quantity of scraped lint. Next a compress dipped in warm camphorated spirit of wine must be applied and retained by the kerchief bandage. Then the patient is to be left, if the disorder will permit, for a few hours, that the blood may be stopped before the trepan is applied. Among the apparatus, or instruments and dressings, which must be provided before the operation is entered upon, the first and principal is the trepan with its crown, (plate CXXXI. *fig.* 10.) made in the shape of a common gimblet with a handle turning round. The crown of this instrument, marked A, is joined to the lower part of the handle, B, by a screw, so that it may be taken off and put on at pleasure, or else that a crown of another size may be screwed in its place. The tre-

pan is distinguished into male and female; in the first of which the crown is furnished with a sharp point E, but when the said point, or pyramid *fig.* 11. is taken out by the winch, *fig.* 12. the trepan is then termed female. You must also be provided with a scalpel of a particular make, with a round and flat head, as represented in *fig.* 13. which is denominated the lenticular scalpel; to which is added another instrument for gradually depressing the dura mater, of the shape represented in *fig.* 14. There must be also a perforating instrument provided, *fig.* 15. which must be screwed into the cavity B of the handle *fig.* 10. also a hair-brush and an elevatory.

The apparatus of dressing and bandage, to be applied after the operation, consists of a dossil of lint, of an orbicular figure, which must be tied round the middle with a piece of thread about a span long; there must be pledgets of lint for covering the other dressings, and filling up the cavity of the cranium, &c.

The apparatus being thus provided, in order to perform the operation with greater readiness and exactness, the patient must be disposed in such a convenient posture that the surgeon and assistants may have free access to perform each their part. Then the dressings being removed, the wound is to be cleansed; after which, the head being placed in a convenient manner upon a pillow, the surgeon takes the perforating trepan, *fig.* 15. and adapting it to the handle B, *fig.* 10. instead of the crown A, so that by turning round the handle D, he makes a full entrance, or aperture, with his instrument, and then applies the male trepan, with a crown A, *fig.* 10. Upon the top of the handle C C, the surgeon fixes his left hand, upon which he places his chin or forehead, while with his right he slowly and carefully turns round the handle till the crown of the trepan with its spindle have made a circular entrance deep enough in the cranium, and then he removes the spindle, and continues his work with the crown of the trepan only as long as he sees convenient; all the saw-dust being first brushed off from the cranium, and the teeth of his instrument, with the brushes. He now continues to use the trepan till the saw-dust becomes bloody, which denotes that he has penetrated the diploë: however, he may not always meet with this sign, because in some skulls the diploë may be wanting in the part trepanned; but when the saw-dust becomes bloody, the instrument is to be laid aside: and after washing away the blood with a sponge dipt in spirit of wine, he then screws the elevatory, by two or three turns, into the small aperture in the middle of the trepanned piece of the bone, and takes it out again, making two or three more turns with the crown of his trepan: then he examines with a probe, whether the plates of the cranium are sufficiently sawed through, which cannot be better known than by attending to the colour of the circular groove; for when that appears blue or grey, it is a sign that you have penetrated through the lower plate of the bone, so far as to render the dura mater almost conspicuous through it; but if the bony plate appears livid in one part of the circular groove, and white in another, it is a sign that the trepan has not cut equally through, and therefore it must be inclined and pressed a little harder upon the whitest parts, moving round the handle till the saw-teeth of the crown have cut deep enough to make the round piece of the bone loose or moveable. In that case it will not be convenient to cut totally through the bone with the saw-teeth of the trepan.

Having thus extracted the round piece of the cranium, the blood usually follows it: which being wiped off, the surgeon is to examine whether there be any fragments remaining to be extracted and loosened; for then you must smooth the rough parts about the lower margin of the aperture, by applying the scalpel, *fig.* 13. to prevent the dura mater from being pricked and injured by any of the sharp splinters. This done, the blood will more readily discharge itself, but to promote its exit you may gently incline the patient's head to one side, and another tenderly pressing the dura mater itself, either by the hand of the scalpel, or the depressor, *fig.* 14. by which means the patient is no sooner relieved from the pressure of the extravasated blood on his brain, but he instantly begins to recover his senses; the surgeon should then direct him to fetch a deep breath, or hold it with a strain, like one that has a hard stool.

The dressings and deligation are to be made with a round pledget of dry lint laid next the dura mater, with a thread fastened to it, and hanging out of the aperture, that it may be placed under, and drawn out from beneath the cranium; upon which pledget is afterwards poured some honey of roses diluted with a little spirit of wine: you then impose a like pledget of lint, furnished with a string with other dossils, till the cavity is replete: and, in the next place, the cranium, and wound itself, is to be dressed with lint, spread with some digestive ointment, upon which add a square compress dipt in warm spirit of wine, and then secure the whole without a plaster, by the head bandage. In the subsequent dressings, which must be repeated once or twice every day, you must avoid fat and oily applications.

The wound being constantly attended, you will have an exfoliation of a thin plate from the trepanned margin of the bones, usually within forty or fifty days, which ought not to be pulled away by force. The exfoliation being obtained, there will appear new flesh and callus shooting up from the clean bone and dura mater, so as at length to fill up the whole cavity.

That instrument called the exfoliating trepan, is sometimes used to pare away a carious part in a bone. It is represented in *fig.* 16. and when used is to be screwed into the handle B of *fig.* 10, in order to be turned round: A is its point: B B the wings, which scrape the bone while the instrument is turning about.

TREPIDATION, in medicine, the same with tremor. See TREMOR.

TREPIDATION, in the ancient astronomy, denotes what they call a libration of the eighth sphere, or a motion which the Ptolemaic system attributed to the firmament, to account for certain almost insensible changes and motions observed in the axis of the world, by means of which the latitudes of the fixed stars come to be gradually changed, and the ecliptic seems to approach reciprocally first towards one pole, then towards the other. This motion is called the motion of the first libration.

TRESPASS, in law, signifies any transgression of the law under treason, felony, or misprision of treason.

TRESPASS, however, is commonly used either for that wrong or damage which is done to the king in his forest, or by one private man to another.

TRESSURE, in heraldry, a diminutive of an orle, usually held to be half the breadth thereof.

TRET, in commerce, an allowance made for the waste, or the dirt, that may be mixed with any commodity, which is always four pounds in every one hundred and four pounds weight.

TRIA PRIMA, among chemists, the three hypostatical principles, viz. salt, sulphur, and mercury; of which they hold all bodies to be primarily made, and into which they are all held resolveable by fire.

TRIAL, in law, the examination of a cause, civil or criminal, according to the laws of the land, before a proper judge: or, it is the manner and order observed in the hearing and determining of causes.

There are divers kinds of trials; as those of matters of fact, which must be tried by a jury; matters of law, which are only triable by the courts; and matters of record, which are to be tried by the records themselves. The most general rule has been, that the jurymen on a trial shall be chosen out of that town or precinct, &c. in which the matter of fact is alledged, or the nearest thereto, for the better cognizance of the matter, and not to leave things to be tried in foreign countries, where the jury are strangers to the whole matter. Where any trial is for murder, it must be in the county wherein the fact was committed; but if the assault be in one county, and the person assaulted happens to die in another county, the indictment may be found by a jury of the county where the party died: and by special commission, when a person is indicted in one county, he may be tried in another. In all criminal cases the custom is to ask the prisoner how he will be tried, which was formerly a very significant question, though it is not so now, because antiently there were trials by combat, by ordeal, and by jury; and

and when the priſoner anſwered, by God and his country, it appeared he made choice to be tried by a jury; which is the only way now uſed for the trial of criminals.

The method of proceeding in criminal caſes is this: firſt the bill of indictment againſt the offender is prepared, and the proſecutor and his witneſſes attend on the grand jury therewith, and there give in their evidence; which being done, the grand inqueſt either find the bill of indictment, or bring it in ignoramus; and if the bill be found, the priſoner is brought to the bar of the court, and the clerk of the arraignment calling him by his name, deſires him to hold up his hand, ſaying, "Thou art indicted by the name of ——, for ſuch a felony, &c. ſetting forth the crime laid in the indictment. How ſayeſt thou, art thou guilty of this felony whereof thou art indicted, or not guilty?" To which the priſoner anſwering, "Not guilty," the clerk ſays, "Culprit, how wilt thou be tried?" whereupon the defendant anſwers, "By God and my country;" which plea of the priſoner the clerk records, and then the pannel of the petty-jury is called over.

After the jury are ſworn, and the indictment is read over to them, and they are charged, the evidences on both ſides, for and againſt the priſoner, are called, ſworn, and examined in open court; after which the jury bring in their verdict; and if they find the priſoner guilty, their verdict is recorded, and the priſoner is taken from the bar: but if they bring him in not guilty, the priſoner is bid to fall down on his knees, &c. On the priſoner's being brought in guilty, proclamation is made for all perſons to keep ſilence, upon which the priſoner is again brought to the bar, and the verdict repeated: after which ſentence is paſſed on him, and an order or warrant is made for his execution.

The methods of trial, in our civil courts, are as follows: viz. The declaration is firſt drawn for the plaintiff, and when the appearance of the defendant is entered, it has been uſual to deliver it with an imparlance to the defendant's attorney; and the term following rule is to be given with the ſecondary for the defendant to plead by ſuch a day, or elſe the plaintiff is to have judgment: and the defendant having pleaded, a copy of the iſſue is made by the plaintiff, and delivered to the defendant's attorney, at the ſame time giving him notice of the trial; in order to which the *venire facias* muſt be taken out and returned by the ſheriff; and likewiſe the *habeas corpora*, or *diſtringas*, to bring in the jury; on which the record is made up, and the parties proceed to trial by their council and witneſſes, and the jury give in their verdict, &c. But in caſe the defendant neglects to plead, and ſuffers it to go by default, on entering ſuch a judgment, a writ of inquiry of damages is awarded returnable next term; notice of the execution whereof the defendant's attorney is to have, and which being executed, and the damages inſerted in a ſchedule annexed to the writ, a rule is given thereon, and coſts are taxed by the prothonotary, &c.

TRIANGLE, in geometry, is a figure of three ſides and three angles, and is either plane or ſpherical.

Plane TRIANGLE, is that contained under three right lines.

Spherical TRIANGLE, is that contained under three arches of a great circle of the ſphere.

Of *Plane Triangles* there are ſeveral ſorts, as,

1. *A Right-Angled* TRIANGLE, is that which hath one right angle.

2. An obtuſe-angled triangle, is ſuch as hath one obtuſe angle.

3. An acute-angled triangle, is that which hath all its angles acute.

4. Any triangle that is not right-angled, is called oblique-angled.

5. An equilateral triangle, is that which hath all its ſides equal to one another.

6. An iſoſceles triangle, is that which hath only two ſides equal.

7. A ſcalenous triangle, is that which hath no two ſides equal.

In every triangle the ſum of all the three angles is equal to two right ones, and the external angle, made by any ſide produced, is equal to the two internal oppoſite angles taken together.

In every triangle, as well plane as ſpherical, the ſines of the ſides are proportional to the ſines of the oppoſite angles.

The ſide of an equilateral triangle, inſcribed in a circle, is, in power, triple of the radius.

In every right-angled triangle, the ſquare of the hypothenuſe is equal to the ſum of the ſquares of the other two ſides.

Triangles on the ſame baſe, and having the ſame height, that is, between the ſame parallel lines, are equal.

Every triangle is one half of a parallelogram of the ſame baſe and height.

The area of any right-lined triangle may be had, by multiplying the baſe by half the perpendicular height, or the perpendicular height by half the baſe.

The area of any plane triangle may be had by adding all the three ſides together, and taking half the ſum, and from that half ſum ſubtracting each ſide ſeverally, and multiplying that half ſum and the remainder continually into one another, and extracting the ſquare root of the product.—For the ſolving the ſeveral caſes of plane and ſpherical triangles, ſee TRIGONOMETRY.

TRIANGULAR *Compaſſes*, are ſuch as have three legs, or feet, whereby to take off any triangle at once; much uſed in the conſtruction of maps, globes, &c.

TRIANGULAR *Numbers*, are a kind of polygonal numbers, being the ſums of arithmetical progreſſions, the difference of whoſe terms is 1.

Thus of arithmetical progreſſion, 1 2 3 4 5 6, are formed triangular numbers 1 3 6 10 15 21.

TRIANGULAR *Canon*, the tables of artificial ſines, tangents, ſecants, &c.

TRIANGULAR *Quadrant*, is a ſector furniſhed with a looſe piece, whereby to make it an equilateral triangle.

The calendar is graduated thereon, with the ſun's place, declination, and other uſeful lines; and by the help of a ſpring and a plummet, and the diviſions graduated on the looſe piece, it may be made to ſerve for a quadrant.

TRIANGULARIS, in anatomy, a name given to two muſcles in reſpect of their figure.

The triangularis pectus, which has ſometimes the appearance of three or four diſtinct muſcles, ariſes from the inſide of the ſternum, and is implanted into the cartilages, which join the four loweſt true ribs to the ſternum.

The action of this muſcle is very obſcure, ſince both the organization and inſertion are at parts not moveable, but together.—Dr. Drake conjectures it may conduce towards forming the neceſſary incurvation of the ſternum, and by its over-tenſion in children, while the cartilages are ſoft, may occaſion that morbid acumination in the ſternum ſeen in rickety children.—Others ſuppoſe it may contract the cavity of the thorax in expiration.

TRIARII, in the Roman militia, a kind of infantry armed with a pike, a ſhield, a helmet, and a cuiraſs; thus called becauſe they made the third line of battle.

TRIAS HARMONICA, or *the harmonical* TRIAD, in muſic, a compound of three radical ſounds, heard all together, two whereof are a fifth and third above the other, which is a fundamental.

TRIBE, *Tribus*, in antiquity, a certain quantity or number of perſons, when a diviſion is made of a city or people into quarters or diſtricts.

The tribes of ancient Rome bore a great reſemblance to our wards.

TRIBRACHYS, in ancient poetry, a foot conſiſting of three ſyllables, and thoſe all ſhort; as *melius*.

TRIBULUS, caltrop, in botany, a genus of plants, the corolla of which conſiſts of five oblong, obtuſe, and patent petals: its fruit is of a roundiſh figure and aculeated, being compoſed of five capſules, gibbous on one ſide, and armed with three or four points on the other, angulated and convergent; and containing numerous ſeeds, turbinated and oblong.

There are three ſpecies of this plant enumerated by Mr. Miller; the firſt of which is very common in the ſouth of France, in Spain, and Italy, where it grows among corn, and on moſt of the arable land, and is very troubleſome to the feet of cattle; for the fruit being armed

armed with ſtrong prickles, run into the feet of cattle, which walk over the land. This is certainly the plant which is mentioned in Virgil's Georgics, under the name of tribulus, though moſt of his commentators have applied it to other plants.

It is called in Engliſh caltrop, from the form of the fruit, which reſembles thoſe inſtruments of war that were caſt in the enemies way to annoy their horſes.

This hath a ſlender fibrous root, from which ſpring out four or five ſlender hairy ſtalks, which ſpread flat on the ground, garniſhed at each joint with winged leaves, compoſed of ſix pair of narrow hairy lobes, almoſt of equal ſize; thoſe on the lower part of the ſtalk ſtand alternately, but toward the top they are placed oppoſite. The flowers come out from the wings of the ſtalk, ſtanding upon ſhort foot-ſtalks; they are compoſed of five broad, obtuſe, yellow petals, which ſpread open. In the center is ſituated an oblong germen, crowned by a headed ſtigma, attended by ten ſhort ſtamina, terminated by ſingle ſummits, and are ſucceeded by roundiſh, five-cornered, prickly fruit, which, when ripe, divides into five parts, each having a tranſverſe cell, containing one or two ſeeds.

This plant is preſerved in botanic gardens for variety. It is propagated by ſeeds, which ſhould be ſown in autumn; for thoſe which are kept out of the ground till ſpring, commonly remain in the ground a whole year before the plants come up. Theſe ſeeds ſhould be ſown on an open bed of light earth, where they are deſigned to remain; for, as it is an annual plant, it doth not bear tranſplanting very well, unleſs it be done when the plants are very young. In the ſpring when the plants come up, they ſhould be carefully cleared from weeds; and where they come up too cloſe, ſome of the plants ſhould be pulled out to give room for the remaining plants to grow; after this they will require no other culture but to keep them clear from weeds. If the ſeeds are permitted to ſcatter, the plants will come up the following ſpring, and maintain their place, if they are not overborne with weeds.

The ſecond ſort grows naturally in Jamaica, and ſome of the other iſlands in the Weſt-Indies; this is an annual plant, with pretty thick, compreſſed, channelled ſtalks, which trail upon the ground, garniſhed with ſmooth winged leaves, placed by pairs oppoſite; they are ſometimes compoſed of three, but moſt commonly of four pair of lobes, the outer being the largeſt. The flowers come out from the wings of the ſtalk; they are compoſed of five large yellow petals, which ſpread open, and have an agreeable odour; theſe are ſucceeded by roundiſh prickly fruit, ending in a long point, but ſeldom ripen in England.

The third ſort grows naturally in the Weſt-Indies; it was found by the late Dr. Houſtoun at the Havanna; this has a ligneous root, from which ſpring out many ſtalks, which are hairy, jointed, and trail upon the ground, garniſhed at each joint by winged leaves, which differ greatly in ſize, ſome being compoſed of eight pair of oblong lobes which are nearly equal, but oppoſite to theſe come out ſmall leaves compoſed of but four pair of lobes. The large leaves ſtand alternately upon the ſtalks, and the ſmall ones on the oppoſite ſide; at the wings of the ſtalks come out the foot ſtalks of the flowers, which are hairy, and near two inches long, each ſuſtaining one pale yellow flower, compoſed of five large petals, which have narrow tails, but are very broad and rounded at their points. The flowers are ſucceeded by roundiſh fruit armed with very acute ſpines, but theſe rarely ripen in England.

The two laſt ſorts being natives of hot countries, are very tender, ſo muſt be ſown in pots in autumn, and plunged into the tan-bed in the ſtove: when the plants are come up, they muſt each be tranſplanted into a ſeparate pot, and then plunged into a hot-bed of tanners bark, where they muſt be treated in the ſame manner as other tender exotic plants, being careful to bring them forward as early as poſſible in the ſummer, otherwiſe they will not perfect their ſeeds in this country.

The third ſort will live through the winter, if it is plunged in the bark-ſtove, and treated in the ſame manner as other tender plants, and the following ſummer they will flower earlier, ſo there will be more time for the ſeeds to ripen.

TRIBUNAL, in general denotes the ſeat of a judge, called in our courts bench.

The word is Latin, and takes its origin from the ſeat where the tribune of the Roman people was placed to adminiſter juſtice.

The name tribunal was alſo given to the place from whence the people of antient Rome were harangued.

TRIBUNE, *Tribunus Plebis*, among the antient Romans, a magiſtrate choſen out of the commons, to protect them againſt the oppreſſions of the great, and to defend the liberty of the people againſt the attempts of the ſenate and conſuls.

The tribunes of the people were firſt eſtabliſhed in the year of Rome 259. The firſt deſign of the creation was to ſhelter the people from the cruelty of uſurers, and to engage them to quit the Aventine mount, whither they had retired in diſpleaſure.

Their number, at firſt, was but two; but the next year, under the conſulate of A. Poſthumus Aruncius and Caſſius Viſcellinus, there were three more added; and this number of five was afterwards increaſed, by L. Trebonius, to ten. The appellation, tribune, was given them, by reaſon they were at firſt choſen out of the tribunes of the army.

Military TRIBUNE, *Tribunus Militum*, or *Militaris*, an officer in the Roman army who commanded in chief over a body of forces, particularly the diviſion of a legion, much the ſame with our colonel, or the French meſter de camp.

TRIBUNE was alſo an appellation given to various other officers; as the tribuni ærarii, tribunes of the treaſury. Tribune of the celeres, the officer who commanded them. Tribuni fabricarum, thoſe who had the direction of the making of arms. Tribuni marinorum, tribuni nolanorum, tribuni voluptatum, mentioned in the Theodoſian Code, as intendants of the public ſhews, and other diverſions. The title of tribune, *tribunus*, was alſo given to the chief of each tribe.

TRIBUTARY, *Tributarius*, one who pays tribute to another, in order to live in peace with him, or ſhare in his protection.

TRIBUTE, *Tributum*, a tax or impoſt which one prince or ſtate is obliged to pay to another, as a token of dependence, or in virtue of a treaty, and as a purchaſe of peace.

The Romans made all the nations they ſubdued pay them tribute. Mahomet laid it down as a fundamental of all his law, that all the world ſhould pay him tribute. In the ſtates of the grand ſeignior Chriſtian children are taken by way of tribute. See AGEMOGLANS.

Tribute is ſometimes alſo uſed for a perſonal contribution, which princes lay upon their ſubjects, by way of poll money.

TRICEPS, in anatomy, the abductor muſcle of the thigh, having three heads and as many inſertions: the firſt and ſecond heads of this muſcle ariſe from the os pubis, near the ſynchondroſis; the third, from the tubercle of the iſchium; and it is inſerted into the whole ſpine of the os femoris.

TRICHERIÆ, a genus of foſſils, naturally and eſſentially ſimple, not inflammable nor ſoluble in water; being fibroſe bodies, not elaſtic, and compoſed of ſtraight and continuous filaments.

To this genus belongs the gypſum ſtriatum of authors, with ſeveral other ſpecies.

TRICHESTRUM, in natural hiſtory, the name of a genus of foſſils, of the claſs of the ſelenitæ, but differing extremely in figure and ſtructure from the common kinds.

The ſelenitæ of this genus are compoſed of filaments ſcarce any where viſibly arranged into plates or ſcales, but diſpoſed in form of a radiated ſtar, made of a number of disjunct ſtriæ.

TRICHIASIS, in ſurgery, an inverſion of the eyelids, whereby the eye-laſhes hurt the eyes.

According to Heiſter, this diſorder is very difficultly remedied; ſince it is hardly poſſible to remove it, ſo as to pre-

prevent its returning, without extirpating the offending hairs; and if theſe be cut off cloſe, it will be to no purpoſe, becauſe the rigid ſtumps of the hairs will irritate the eye even worſe than the whole hairs did before. It is a very nice operation alone that can make a cure; here the hairs muſt be pulled up ſingly by the roots, and the places of their inſertion ſingly cauterized with a hot broad pointed needle; but this the patient will ſeldom ſubmit to, and the only remaining method then, is to fill up the ſinus's out of which they were extracted with the lapis infernalis. But in this the greateſt care muſt be taken, that no part of that application get into the eye. The eaſieſt method is the touching the cavities, out of which the hairs have been pulled up, with a pencil-bruſh dipped in a mixture of ſpirit of ſal-armoniac and highly rectified ſpirit of wine, by which means they will cloſe up, and no more hairs will grow from them.

TRICHILIA, in botany, a genus of plants, whoſe flower conſiſts of five lanceolated patent petals, with a cylindric tubuloſe nectarium, cut at the mouth into five indentures; the ſtamina have no filaments, but conſiſt of ten erect aſſurgent antheræ: the fruit is a roundiſh almoſt trigonal capſule, having three cells, each containing a ſingle ſeed.

TRICHOMANES, in botany, a genus of plants of the fern kind; the viſible parts of the fructification conſiſts of a turbinated erect calyx ſtanding ſingly on the very margin of the leaf, and a ſetaceous ſtyle terminating the capſule.

TRICHOSANTHES, in botany, a genus of plants, whoſe flowers are male and female, and grow on the ſame plant; the male flower is monopetalous, and divided into five ſegments, and contains three very ſhort filaments, topped with cylindrical erect antheræ, joined in a body; the female flower is like the male, and the fruit is long, ſucculent, and trilocular, containing many obtuſe compreſſed ſeeds. This genus comprehends the anguina of Micheli.

TRICHOSTEMA, in botany, a genus of plants, whoſe flower is monopetalous and ringent; the tube is very ſhort; the upper lip is compreſſed and falcated, and the under one is divided into three parts, the middle one being oblong and ſmalleſt: the ſtamina are four very long filaments, topped with ſingle antheræ; there is no pericarpium, but the cup contains four roundiſh ſeeds.

TRICUSPIDES, VALVÆ, in anatomy, a name given to the mitral valves, placed at the juncture of the right auricle and ventricle of the heart.

TRIDAX, American ſtarwort, in botany, a genus of plants, whoſe flowers are compound and radiated, conſiſting of hermaphrodite florets, which form the diſc, and ligulated female corollulæ, which compoſe the rays; the cup, which is cylindrical and imbricated, contains the ſeeds, which are oblong and crowned with down.

TRIDENT, *Tridens*, an attribute of Neptune, being a kind of ſceptre which the painters and poets put into the hands of that god, in form of a ſpear, or fork, with three teeth; whence the word.

TRIDENT, among mathematicians, is uſed for a kind of parabola, by which Des Cartes conſtructed equations of ſix dimenſions.

TRIEDROSTYLA, in natural hiſtory, the name of a genus of ſpars, in form of trigonal columns, adhering by one end to ſome ſolid body, and terminated at the other by a trigonal pyramid. See SPAR.

Of this genus there are four known ſpecies. 1. A ſlender one, with a long, obtuſe pyramid: this is one of the moſt common of all the ſpars, and is found in almoſt all parts of the world, ſometimes in ſingle and large ſpecimens, but more frequently in large congeries, coating over the fiſſures of ſtone, in form of cruſts. 2. One with ſhort, but pointed pyramids, common on Mendip-hills, and found in ſome other parts of England. 3. A thick one, with a longer pyramid, found in Northamptonſhire, and ſome other parts of the kingdom, encruſting the fiſſures of ſtone. And, 4. One with a very ſhort column, and a long, obtuſe pyramid: this is frequent in the mines of Germany, and not leſs ſo in thoſe of England, particularly in Derbyſhire.

TRIEMIMERES, a kind of cæſura in Latin verſe, wherein after the firſt foot of the verſe there remains an odd ſyllable, which helps to make up the next foot.

TRIENNIAL, an epithet applied chiefly to offices or employments which laſt for three years.

TRIENS, in antiquity, a copper money of the value of one third of an as, which on one ſide bore a Janus's head, and on the other a water-rat.

This was the piece of money uſed to be put in the mouths of the deceaſed to pay Charon his fare, for their paſſage into another life.

TRIENTALIS, in botany, a genus of plants, whoſe flower is ſtellated and monopetalous, with the corolla divided into ſeven ovato-lanceolated ſegments; the ſtamina conſiſts of ſeven capillary filaments, inſerted into the ungues of the corolla, and topped with ſingle antheræ.

TRIEXAHÆDRIA, in natural hiſtory, the name of a genus of perfect and pellucid, cryſtalliform ſpars, conſiſting of thrice ſix planes, being compoſed of an hexangular column, terminated at each end by an hexangular pyramid. Of this genus there are three known ſpecies. 1. A clear one, with narrow and oblong pyramids: this is found in the mountains of Germany and in North Wales; but with us it is ſmall and coarſe. 2. One with ſhort pyramids, and a long column: this is found in the mines at Goſſelaer, in Saxony. And, 3. One with ſhort pyramids, and a thick and ſhort column, found with us in the lead-mines of Yorkſhire.

TRIGA, in antiquity, denotes a kind of carr, or chariot, drawn by three horſes; whence the name.

TRIGAMY, a third marriage, or the ſtate of a perſon who has been married three times.

TRIGLA, in ichthyology, a genus of fiſhes, the characters of which, according to Artedi, are theſe: the branchioſtege membrane contains ſeveral bones; the head is very declivious, from the eyes to the end of the ſnout, and is large, aculeated, and as it were ſquare; the head is the broadeſt part of the fiſh; it thence grows gradually narrower, till it ends in a very ſmall tail; in many of the ſpecies of this fiſh, there are two or three articulated appendices growing under the pectoral fins: the eyes ſtand on the top of the head, and are covered with a ſkin; there are two back fins, the firſt of which is prickly; the pectoral fins in ſome of the ſpecies are very large.

TRIGLYPHS, in architecture, a ſort of ornaments repeated at equal intervals in the Doric freeze.

Each triglyph conſiſts of two entire gutters, or channels, cut to a right angle, called glyphes, and ſeparated by three interſtices, called, by Vitruvius, femora, from each other, as well as from two other half channels which are at the ſides.

The ordinary proportion of triglyphs is to be a module broad, and one and a half high. But this proportion, M. le Clerc obſerves, ſometimes occaſions ill-proportioned intercolumniations in porticos; for which reaſon he chooſes to accommodate the proportion of his triglyphs to that of the intercolumns.

TRIGON, τριγωνον, a triangle. See TRIANGLE.

In aſtrology, trigon denotes the ſame with trine. See TRINE.

TRIGONELLA, fenugreek, in botany. See the article FENUGREEK.

TRIGONOMETRY, the art whereby, from any three parts of a triangle, except the three angles, (when the triangle is a plane one) the reſt are diſcovered.

The word is formed from the Greek τριγωνος, a triangle, and μετρεω, to meaſure.

Trigonometry is either plane or ſpherical.

Plane TRIGONOMETRY, is the method of ſolving plane triangles.

Solution of the ſeveral caſes of plane TRIGONOMETRY.

Caſe I. The angles and one of the legs of a right-angled plane triangle being given, to find the other leg.

Example. In the triangle ABC (plate CXXXII. *fig.* 1.) right-angled at B,

Are given AB = 52 equal parts, as yards, furlongs, miles, &c.

And the angle CAB = 36 deg. 52 min. required BC.

The

The geometrical ſolution.—1. Make A B equal to 52, by a line of equal parts.

2. Extend your compaſſes to the diſtance of the radius of your line of chords, and with this diſtance, ſetting one foot in A, deſcribe the arch *e f*, and from *f* towards *e* ſet off 36 deg. 52 min. the angle at A, on the arch *f e*.

3. Erect the perpendicular B C.

4. From A, through the interſection *e*, draw the line A C, meeting the perpendicular B C in C; then is the triangle conſtructed, and the perpendicular B C may be meaſured, by applying it to the ſame line of equal parts from whence A B was taken.

The arithmetical ſolution. 1. By ſuppoſing A C the radius.

Produce A C (plate CXXXII. *fig.* 1.) to *c*, till A *c* be equal to the tabular radius 10000000, &c. then will *b c* be the tabular ſine of the arch *c d*, and A *b* will be the tabular co-ſine of the ſame arch: alſo, B C will be the ſine of the arch B D, and A B the co-ſine of the ſame arch.

And becauſe the triangles A B C, A *b c*, are ſimilar, it will be,

As A *b* : A B :: *b c* : B C. That is,

A *b* (the tabular co-ſine of the arch *c b*) = 36° 52′ =	9,9031084
To A B (the co-ſine of the arch C D in the ſcheme) = 52 =	1,7160033
So is *b c* (the tabular ſine of the arch *c d*) = 36° 52′ =	9,7781186
To C B (the ſine of the arch C D in the ſcheme) required = 39 =	1,5910135

2. By ſuppoſing A B (*fig.* 2.) the radius.

Produce A B to *b*, till A *b* be equal to the tabular radius, then will *b c* be the tabular tangent of the arch *b d*, and B C the tangent of the arch B D.

And becauſe the triangles A B C, A *b c*, are ſimilar, it will be,

As A *b* : A B :: *b c* : B C. That is,

As A *b* (the radius in the tables) = 90° =	10,0000000
To A B (the radius of the ſcheme) = 52 =	1,7160033
So is *b c* (the tangent of the arch *b d* in the tables) = 36° 52′ =	9,8750102
To B C (the tangent of the arch B D in the ſcheme) = 39 =	1,5910135

3. By ſuppoſing B C (*fig.* 3.) the radius.

Produce C B to *b*, till C *b* be equal to the tabular radius, then will *a b* be the tabular tangent of the arch *b d*, or angle *a* C *b*, the complement of the given angle; alſo, A B will be the tangent of the arch B D.

And becauſe the triangles C *a b*, C A B, are ſimilar, it will be,

As *a b* : A B :: C *b* : C B. That is,

As *a b* (the tabular tangent of the arch *b d* 53° 8′)	10,1249898
To A B (the tangent of the arch B D in the ſcheme) 52,	1,7160033
So is C *b* (the tabular radius) = 90° =	10,0000000
To C B (the radius of the ſcheme) = 39 =	1,5910135

Caſe II. The angles and one of the ſides of a right-angled plane triangle being given, to find the hypothenuſe.

Example. In the triangle A B C (*fig.* 1.) right-angled at B, are given the angle C A B, = 36 deg. 52 min. and the ſide A B = 52 equal parts; required the hypothenuſe A C.

Geometrically. This caſe is conſtructed, in all reſpects, like the former, and A C may be meaſured by the ſame line of equal parts which A B was taken from.

Arithmetically. 1. By ſuppoſing A C (*fig.* 1.) the radius.

Produce A C to *c*, till A *c* be equal to the tabular radius, then will *b c* be the ſine of the arch *c d*, and C B the ſine of the arch C D; alſo, A *b* will become the co-ſine of the arch *c d*; or, which is all one, the ſine of its complement, and A B the co-ſine of the arch C D, or ſine of its complement.

And becauſe the triangles A B C, A *b c*, are ſimilar, it will be,

As A *b* : A B :: A *c* : A C. That is,

As A *b* (the tabular co-ſine of the arch *c d*) 36° 52′ =	9,9031084
Is to A B (the co-ſine of the arch C D in the ſcheme) = 52 =	1,7160033
So is A *c* (the tabular radius) = 90° =	10,0000000
To A C (the radius in the ſcheme) = 65 =	1,8128949

2. By ſuppoſing A B the radius.

Produce A B (*fig.* 2.) to *b*, till A *b* be equal to the tabular radius, then will *b c* be the tangent of the arch *d b*, and A *c* the ſecant of the ſame arch; alſo, B C will be the tangent of the arch B D, and A C the ſecant of the ſame.

And, becauſe the triangles A B C, A *b c*, are ſimilar, it will be,

As A *b* : A B :: A *c* : A C. That is,

As A *b* (the radius in the tables) = 90° =	10,0000000
Is to A B (the radius in the ſcheme) = 52 =	1,7160033
So is A *c* (the ſecant of the arch *b d* in the tables) = 36° 52′ =	10,0968916
To A C (the ſecant of the arch B D in the ſcheme) 65,	1,8128949

3. By ſuppoſing B C (*fig.* 3.) the radius.

Produce C B to *b*, till C *b* be equal to the tabular radius, then will *a b* be the tabular tangent of the arch *b d* (or angle *a* C *b*) and C *a* will be the ſecant of the ſame arch; alſo, A B will be the tangent of the arch B D, and C A the ſecant of the ſame arch.

And becauſe the triangles *a b* C, A B C, are ſimilar, it will be,

As *a b* : A B :: C *a* : C A. That is,

As *a b* (the tabular tangent of the arch *b d*) 53° 8′	10,1249898
Is to A B (the tangent of the arch D B in the ſcheme) 52,	1,7160033
So is C *a* (the tabular ſecant of the arch *b d*) 53° 8′	10,2218814
To C A (the ſecant of the arch B D in the ſcheme) 65,	1,8128949

By carefully conſidering the three different methods of performing the two preceding caſes, the reader may make theſe three general obſervations:

1. If the hypothenuſe be ſuppoſed the radius, the two legs will become the ſines of their oppoſite angles.

2. If the baſe be ſuppoſed the radius, the perpendicular will become the tangent of the angle at the baſe, and the hypothenuſe the ſecant of the ſame angle.

3. If the perpendicular be ſuppoſed the radius, the baſe will become the tangent of the angle at the perpendicular, and the hypothenuſe the ſecant of the ſame angle.

Caſe III. The hypothenuſe and angles of a right-angled plane triangle being given, to find either of the legs.

Example. In the triangle A B C (*fig.* 1.) right-angled at B, are given the angle C A B = 36 deg. 52 min. and the hypothenuſe A C = 65, required A B.

Geometrically. 1. Draw the line A B at pleaſure.

2. Make the angle at A equal to 36 deg. 52 min. by the line of chords (as taught in the firſt caſe) and continue the line A C, till it be equal to 65, upon the line of equal parts.

3. Let fall the perpendicular C B, and the triangle is conſtructed; and the baſe A B may be meaſured by applying it to the ſame line of equal parts which A C was taken from.

Arithmetically. By ſuppoſing A C (*fig.* 1.) the radius.

Produce A C to *c*, till it equal the tabular radius, then will A *b* = the tabular co-ſine of the angle at A, or the ſine of the angle A *c b*, it being its complement.

And from the ſimilarity of the two triangles A *b c*, A B C, it will be,

As

As A *c*: AC::A *b*: AB. That is,
As A *c* (the radius in the tables = 90° = 10,0000000
To A C (the radius in the ſcheme) = 65 = 1,8128949
So is A *b* (the co-ſine of the arch *c d* in the tables) = 36° 52′ = —— —— 9,9031084

To A B (the co-ſine of the arch C D in the ſcheme) = 52 = —— —— —— 1,7160033

Caſe IV. The legs of a right-angled plane triangle being given, to find the angles.

Example. In the right-angled plane triangle A B C (*fig.* 1.) are given the baſe A B = 52, and the perpendicular B C = 39, required the angles A and C.

Geometrically. 1. Make A B equal to 52, from a line of equal parts.

2. From the point B erect the perpendicular B C, and ſet off on it 39 equal parts from B to C; and join the points A C with the right line A C, and the triangle is conſtructed; and the quantities of the angles A and C may be meaſured by the line of chords, after the manner taught in the firſt caſe.

Arithmetically. By ſuppoſing A B (*fig.* 1.) the radius. Make A *b* equal to the tabular radius, then will *b c* be the tangent of the angle A.

And becauſe of the ſimilarity of the two triangles A *bc*, A B C, it will be,

As A B : A *b* :: B C : *b c*. That is,
As A B (the radius in the ſcheme) = 52 = 1,7160033
To A B (the radius in the tables) = 90° = 10,0000000
So is B C (the tangent of the arch B D in the ſcheme) = 39 = — — 1,5910135

To *b c* (the tangent of the arch *b d* in the tables) = 36 deg. 52 min. = — — 9,8750102

Which, ſubtracted from 90 deg. leaves the angle C = 53 deg. 8 min.

Caſe V. The hypothenuſe and one of the legs of a right-angled plane triangle being given, to find the angles.

Example. In the triangle A B C (*fig.* 1.) right-angled at B, are given the baſe A B = 52, and the hypothenuſe A C = 65, required the angles A and C.

Geometrically. 1. Make A B equal to 52 by a line of equal parts.

2. Erect the perpendicular B C.

3. Take the diſtance of 65 equal parts between the points of the compaſſes, and ſetting one foot in A, with the other croſs the perpendicular B C in C, and join the points A and C with a right line, and the triangle is conſtructed; and the quantities of the angles may be meaſured by the line of chords, after the manner taught in the firſt caſe.

Arithmetically. By ſuppoſing the hypothenuſe A C the radius.

Make A *c* (*fig.* 1.) = the radius of the tables, then will A *b* repreſent the tabular co-ſine of the arch *c d*.

And becauſe the triangles A *b c*, A B C, are ſimilar, it will be,

As A C : A *c* :: A B : A *b*. That is,
As A C (the radius in the ſcheme) = 65 = 1,8128949
To A *c* (the radius in the tables) = 90 = 10,0000000
So is A B (the coſine of the arch C D in the ſcheme) = 52 = —— 1,7160033

To A B (the coſine of the arch C *d* in the tables) = 53 deg. 8 min. = —— 9,9031084

Whoſe complement is 36 deg. 52 min. the angle at A.

Caſe VI. The legs of a right-angled plane triangle being given, to find the hypothenuſe.

Example. In the right-angled triangle A B C (*fig.* 1) there are given A B = 52, and B C = 39, required A C.

Geometrically. This caſe is conſtructed, in all reſpects, the ſame as the fourth, and the length of A C may be found by applying it to the ſame ſcale of equal parts, which the legs A B and B C were taken from.

The arithmetical ſolution of this caſe is the ſame as that of the ſecond and fourth caſes; for the angles being found as in caſe the fourth, the hypothenuſe may be found according to the ſecond caſe, which will be ſuperfluous here to repeat.

But the hypothenuſe may be found by the help of the 47th of Euc. I. without finding the angles; thus,
To the ſquare of one of the given ſides A B = 2704
Add the ſquare of the other ſide C D —— = 1521
4225

The ſquare root of that ſum will give A C required = 65.

Caſe VII. The hypothenuſe and one of the legs of a right-angled plane triangle being given, to find the other leg.

Example. In the right-angled plane triangle A B C (*fig.* 1.) there are given the hypothenuſe A C = 65, and the baſe A B = 52; required the perpendicular B C.

Geometrically. The geometrical conſtruction of this caſe is performed, in all reſpects, like the fifth, and the perpendicular B C may be found by applying it to the ſame ſcale of equal parts, which the other parts of the triangle were taken from.

This caſe being a compound of the fifth and firſt, we muſt firſt find the angles by the fifth, and the perpendicular by the firſt, to which we refer the reader.

But by the help of the 47th of Euc. I. the perpendicular may be found without the trouble of finding the angles; thus,
From the ſquare of hypothenuſe A C —— = 4225
Take the ſquare of the baſe A B —— —— = 2704
1521

The ſquare root of the remainder will give B C required = 39.

By carefully conſidering the ſolutions of the ſeveral preceding caſes, the reader may obſerve,

1. That, if the angles are given, any ſide, whether given or required, may be ſuppoſed the radius.

2. If the angles are required, one of the given ſides muſt be ſuppoſed the radius.

The ſolution of the ſeveral caſes of oblique-angled plane triangles.

Caſe I. Two ſides and an angle oppoſite to one of them being given, to find the other oppoſite angle.

Example. In the oblique-angled plane triangle A B C (plate CXXXII. *fig.* 4.) are given A B = 52, B C = 42, and the angle A C B = 42 deg. 16 min. required the angle B A C.

Geometrically. 1. Draw the line A C at pleaſure.

2. Make the angle A C B equal to 42 deg. 16 min. by the line of chords, after the manner taught in caſe the firſt of the preceding ſolutions.

3. Make B C equal to 42, by a line of equal parts.

4. Take the diſtance of 52 equal parts between the points of the compaſſes, and ſetting one foot in B, with the other croſs the line A C in A, and join the points A and B, with a right line, and the triangle is conſtructed; and the angle B A C may be meaſured by the line of chords.

Arithmetically. As A B —— = 52 = 1,7160033
To the fine of its oppoſite angle A C B 42° 16′ = 9,8291312
So is B C —— —— —— = 42 = 1,6232493

To the fine of its oppoſite angle C A B, 33° 1′ = 9,7363772

Having found the angle A, the angle B may be found by taking the ſum of the angles A and C from 180 deg.

Caſe II. The angles and one ſide of an oblique-angled plane triangle being given, to find either of the other ſides.

Example. In the oblique-angled plane triangle A B C (*fig.* 4.) are given the angle A = 33° 1′ the angle B = 104° 43′, the angle C = 42° 16′, and the ſide A B = 52, required A C. Geometrically. 1. Make the angle A = 33d. 1m. by the line of chords.

2. Make

2. Make A B = 52, by a line of equal parts.

3. Make the angle B = 104d. 43m. by the line of chords.

4. Draw the lines A C and B C till they interſect each other in C, and the triangle A B C is conſtructed; and A C may be meaſured by the ſame line of equal parts which A B was taken from.

Arithmetically. As the ſine of the angle C— } 9,8291312
—— —— = 42 d. 16 m. = }
To its oppoſite ſide A B —— = 52 = 1,7160033
So is the ſine of the angle B = 104d. 43m. = 9,9855135

To its oppoſite ſide A C —— = 74,5 = 1,8723856

Caſe III. Two ſides and an angle oppoſite to one of them being given, to find the other ſide.

Example. In the oblique-angled plane triangle A B C (*fig.* 4.) are given the ſide A B = 52, the ſide B C = 42, and the angle C = 42d. 16 m. required A C.

Geometrically. This caſe is conſtructed in all reſpects like the firſt, and the ſide A C may be meaſured by applying it to the line of equal parts.

But to perform it arithmetically, it will be,

As the ſide A B — — — = 52 = 1,7160033
Is to the ſine of the angle C— = 42 d. 16m. = 9,8291312
So is the ſide B C — — —— = 42 = 1,6232493

To the ſine of the angle A— = 33d. 1 m. = 9,7363772

Hence the angle B = 104 deg. 43 min.

Then to find the ſide A C it will be, by the ſame theorem,

As the ſine of the angle C— = 42 d. 16 m. = 9,8291312
Is to the ſide A B — — — = 52 = 1,7160033
So is the ſine of the angle B— = 104 d. 43 m. = 9,9855135

To the ſide A C —— — — = 74,5 = 1,8723856

Caſe IV. Two ſides and the contained angle of an oblique-angled plane triangle being given, to find the other angles.

Example. In the oblique-angled plane triangle A B C (*fig.* 3. plate CXXXII.) are given the ſide A C = 74,5, the ſide A B = 52, and angle A = 33 deg. 1 m. required the angles B and C.

Geometrically. 1. Make the line A C = 74,5 by a line of equal parts.

2. Form the angle A = 33 deg. 1 min. by the line of chords.

3. Let A B be made = 52 equal parts.

4. Join the points B and C with a right-line, and the thing is done; and the angles B and C may be meaſured by the line of chords.

To perform this caſe arithmetically, we muſt firſt find the ſum and difference of the two ſides; alſo the half ſum of the two unknown angles, which is performed by ſubtracting the given angle from 180°, and the remainder will be the ſum of the angles B and C, the half of which will be the half ſum required, which will be = 73 deg. 29 m. 30 ſec.

Having found the ſum and difference of the two ſides, as, alſo, the half ſum of the two unknown angles, the required angles will be found thus,

As the ſum of the two ſides A B and A C = 126,5 = 2,1000905
To their difference —— —— = 22,5 = 1,3533825
So is the tangent of the half ſum of the two } 10,5293633
unknown angles —— = 73° 29′ 30″ = }

To the tang. of half their difference = 31° 13′ } 9,7826553
30″ —— —— —— —— —— —— = }
To the half ſum —— —— —— —— = 73° 29′ 30″
Add the half difference —— —— —— = 31° 13′ 30″

Their ſum will be the greater ang. B 104 43 00
From the half ſum —— = 73° 29′ ½
Take the half difference —— = 31° 13′ ½

Their difference = the angle C —— = 42° 16′

Caſe V. Two ſides and the contained angle of any oblique angled plane triangle being given, to find the third ſide.

Example. In the oblique-angled plane triangle A B C (*fig.* 3) are given the ſide A C = 74,5, the ſide A B = 52, and the angle A = 33 deg. 1 min. required the ſide B C.

Geometrically. The geometrical conſtruction of this caſe is exactly the ſame with the laſt, and the ſide B C may be meaſured by the line of equal parts.

This caſe is compounded of the fourth and firſt, and therefore the arithmetical method is the ſame as thoſe two caſes; for the angles B and C muſt be found by caſe the fourth, and the ſide B C will be found by caſe the firſt, to which we refer the reader.

Caſe VI. Three ſides being given, to find the angles.

Example. In the oblique-angled plane triangle A B C (*fig.* 3.) are given the ſide A B = 52, the ſide A C = 74,5, and the ſide B C = 42, required the angles A, B, and C.

Geometrically. 1. Make the line A C = 74,5, from a line of equal parts.

2. Take 52, the length of A B between the points of the compaſſes, and, ſetting one foot in A, with the other deſcribe the arch *d e*.

3. Take 42, the length of B C, between the points of the compaſſes, and, ſetting one foot in C, with the other deſcribe the arch *f g*, interſecting the former in B.

4. From the interſection B draw right-lines to the points A and C, and the triangle is conſtructed; and the angles may be meaſured by the line of chords.

But to perform it arithmetically, it will be,

As the baſe A C (pl. CXXXII. *fig.* 5.) = 74,5 = 1,8721563
To the ſum of the ſides A B, B C — = 94 = 1,9731279
So is the difference of the ſides A B, B C = 10 = 1,0000000

To the difference of the ſegments A F, C F, } 1,100971
12,5 = —— —— —— —— —— }

Which, taken from A C = 74,5, leaves twice C F = 62, the half of which is 31 = the leſſer ſegment F C. Then having the three ſides of a right-angled triangle, the angles are eaſily found.

We ſhall here ſubjoin the following curious and uſeful theorems, for facilitating the operations in plane trigonometry.

Theorem 1. The ſine of the ſum of any two arches, is equal to the ſum of the products of each ſine multiplied into the co-ſine of the other's arch divided by the radius.

Demonſtration. Let A B and A C, (*fig.* 6.) be the double of the given arches, then will B C be the chord of their ſum. Draw the diameter A D, join the points B, D and D, C, let fall A O, perpendicular upon B C. The triangles A O C, A B D, are ſimilar, as are alſo the triangles A O B, A C D; whence we get A B : B O :: A D : C D, and A C : C O :: A D : B D, therefore B O + C O (B C) is equal to $\frac{AB \times CD + AC \times BD}{AD}$;

or by dividing all by 2, we get $\frac{BC}{2} = \frac{\frac{1}{2}AB \times \frac{1}{2}CD}{\frac{1}{2}AD} + \frac{\frac{1}{2}AC \times \frac{1}{2}BD}{\frac{1}{2}AD}$.

Corol. 1. As radius is to the ſine of an arch, ſo is twice its co-ſine, to the ſine of double that arch.

Corol. 2. The ſine of the difference of any two arches is equal to the difference of the products of the ſine of one arch into the co-ſine of the other, divided by the radius.

Theorem 2. As radius is to the ſine of half the ſum of two arches, ſo is the ſine of half their difference, to half the difference of the verſed ſines of the ſame two arches.

Demonſtration. Let A C (*fig.* 7.) be the greater arch, and C D the leſs. Make A B = C D, then B C = A C — C D; draw the chord B C, which biſect in E with the radius F E H. Let fall H *d*, C *c*, and B *a*, perpendiculars to A F, then will H *d* be the ſine of ½ the ſum, and B E the ſine of ½ the difference of the given arches, and *a b* = *b c* will be ½ the difference of their verſed ſines.

The triangles FH*d*, ECK are ſimilar, whence FH : H*d*::EC : EK (*ab*).

Theorem 3. The ſum of the tangents of any two arches is to their difference, as the ſine of the ſum of thoſe arches, is to the ſine of their difference.

Demonſtration. Let AH (*fig.* 8.) be the greater arch, HG (=HI) the leſs; join the points I, G, produce GI to L, draw the tangents HM, HF; upon ME let fall the perpendiculars IK, GD, then will GD be the ſine of the ſum of the given arches, and IK that of their difference. The triangles LGD, LIK are ſimilar, whence GD : KI::LG : LI. The triangles MCF, LCG are ſimilar, whence we have MF : MP :: LG : LI, and therefore GD : KI::MF : MP.

Corol. The ſine of an arch is a mean proportional between half the radius and the verſed ſine of twice that arch: for by letting fall I*b* perpendicular upon CG, the triangles ISC, I*b*G become ſimilar; whence IS : IC::G*b* : 2IS, and therefore $\overline{IS}^2 = \frac{IC}{2} \times G b$.

Theorem 4. The double of the rectangle contained under the co-ſines of two arches divided by the radius, is equal to the ſum of the co-ſines of the ſum and difference of thoſe arches.

Demonſtration. Let AB and BD (*fig.* 9.) equal to BE, be the two arches, and CG and C*n* their reſpective co-ſines to the radius CB; likewiſe let CH be the co-ſine of their ſum AE, and CF that of their difference AD; making *nm* parallel to BG. Then, D*n* being =E*n*, it follows that F*m*=H*m*; and conſequently that 2C*m* = CH + CF: but, by ſimilar triangles, CB : CG::C*n* : C*m*; whence $CG \times 2Cn = \overline{CB \times CH + CF}$, and conſequently $\frac{CG \times 2Cn}{CB} = CH + CF$.

Corol. 1. The double of the rectangles contained under the ſines of any two arches divided by the radius, is equal to the difference of the co-ſines of the ſum and difference of thoſe arches.

Corol. 2. The double of the rectangle under the co-ſine of the one and the ſine of the other, is equal to the difference of the ſines of the ſum and the difference of the ſaid arches.

Theorem 5. The rectangle of the ſines of any two arches being added to that of their co-ſines, is equal to the rectangle of the radius and coſine of the difference of thoſe arches.

Demonſtration. Let HE (*fig.* 10.) be the greater of the given arches, and DE the leſs, then will HD be their difference. Draw the radii CD, CE, and the right ſines DB, EA, and DF; draw alſo OP, from the point of interſection O parallel to DF: then will CE×PE =AE × OE: Euc. 37.3. but CF : PC::CB : AC, by the ſimilar triangles CFD, CPO; and again, BC : CE : : FD : OE; hence we get CF×AC=PC×CB, and BC×OE=CD×FD; conſequently PE × BC = AE×FD; that is, PE×BC + AC×FC=AE× FD + AC×FC=PE×BC+PC×BC=$\overline{PE+PC}$ ×BC=CD×BC.

Spherical TRIGONOMETRY, is the art whereby, from three given parts of a ſpherical triangle, the reſt are diſcovered.

Before we ſhew the method of ſolving the ſeveral caſes of ſpherical trigonometry, we ſhall lay down and demonſtrate the following theorems.

Theorem 1. In any right-angled ſpherical triangle it will be, as radius is to the ſine of the angle at the baſe, ſo is the ſine of the hypothenuſe to the ſine of the perpendicular; and, as radius to the co-ſine of the angle at the baſe, ſo is the tangent of the hypothenuſe to the tangent of the baſe.

Demonſt. Imagine the quadrants CQED, CLFD (*fig.* 11.) raiſed up until they meet in D, and then place the plane CEF perpendicular to the plane CQED, and ſuppoſe the point F of the plane CEF to coincide with the point F of the plane CLFD: By theſe means there will be formed a right-angled ſpherical triangle DEF right-angled at E; then in this triangle it will be, as the radius CF, is to LP, the ſine of the angle EDF at the baſe, ſo is RF, the ſine of the hypothenuſe DF, to FK, the ſine of the perpendicular EF. For the plane FCE is perpendicular to the plane CDE; therefore the right-lined triangle KRF is ſimilar to CLP; whence CL : LP::RF : KF. But CL=CF, whence CF : LP :: RF : KF. Again, as CL the radius is to CP the co-ſine of the angle EDF at the baſe; ſo is CH, the tangent of the hypothenuſe DF, to SC, the tangent of the baſe DE. For the right-lined triangles CHS, CLP are ſimilar, wherefore CL : CP :: CH : CS.

Corol. 1. Hence it follows, that the ſines of the angles of any oblique ſpherical triangle are to one another directly, as the ſines of the oppoſite ſides.

Corol. 2. It follows, moreover, that, in right-angled ſpherical triangles, having one ſide common, the tangents of the hypothenuſes are to each other, inverſely, as the co-ſines of the adjacent angles to the ſide common.

Theorem 2. In any right-angled ſpherical triangle it will be, as radius is to the co-ſine of one ſide or leg, ſo is the co-ſine of the other ſide or leg, to the co-ſine of the hypothenuſe.

Demonſtration. The triangles CEM, CKR, in the laſt figure, are ſimilar; wherefore it will be, as CE radius, is to CK, the coſine of the ſide EF, ſo is MC, the co-ſine of the other ſide DE, to RC, the co-ſine of the hypothenuſe DF.

Corol. Hence, if two right-angled ſpherical triangles have the ſame perpendicular, the co-ſines of their hypothenuſes will be to each other directly as the co-ſines of their baſes.

Theorem 3. In any right-angled ſpherical triangle it will be, as radius is to the ſine of either angle adjacent to the hypothenuſe, ſo is the co-ſine of the adjacent leg, to the co-ſine of the oppoſite angle.

Demonſtration. Produce AC, AE, to F and D, (*fig.* 12) until they become quadrants. Then, by theorem 1. it will be, as radius to the ſine of the angle E, ſo is the ſine of BE, to the ſine of the perpendicular BD; conſequently, as radius is to the ſine of the angle at E, ſo is the co-ſine of EC, to the co-ſine of the angle at A.

Corollary. Hence, in right-angled ſpherical triangles, having the ſame perpendicular, the co-ſines of the angles at the baſe will be to each other, directly, as the ſines of the vertical angles.

Theorem 4. In any right-angled ſpherical triangle it will be, as radius is to the ſine of the baſe, ſo is the tangent of the angle at the baſe to the tangent of the perpendicular.

Demonſtration. Raiſe up the quadrants, as in theorem 1, until they meet in D; then the triangles CQV, MEO will be ſimilar, and conſequently CQ : QV :: EM : EO; but CQ is radius, QV is the tangent of the angle at the baſe, EM is the ſine of the baſe, and EO is the tangent of the perpendicular. Whence it is, as radius to the tangent of the angle at the baſe, ſo is the ſine of the baſe to the tangent of the perpendicular; or by changing the places of the ſecond and third terms, it becomes the theorem required.

Corol. Hence it follows, that, in right-angled ſpherical triangles having the ſame perpendicular, the ſines of the baſes will be to each other, inverſely, as the tangents of the angles at the baſes.

Theorem 5. In any right-angled ſpherical triangle it will be, as radius is to the co-ſine of the hypothenuſe, ſo is the tangent of either angle to the co-tangent of the other angle.

Demonſtration. Produce each ſide of the right-angled ſpherical triangle EDB (*fig.* 13.) to the points FCA, until they are quadrants; then by the laſt theorem it will be, as radius to the ſine of the baſe CE, ſo is the tangent of the angle at E to the tangent of AC: but AC is the complement of the angle at B, and CE that of EB; wherefore it is, as radius is to the co-ſine of the hypothenuſe EB, ſo is the tangent of the angle at E, to the co-tangent of the angle at B.

Lemma. As the ſum of the ſines of two unequal arches is to their difference, ſo is the tangent of half the ſum of thoſe arches to the tangent of half their difference: and, as the ſum of the co-ſines is to their difference, ſo is the co-tangent of half the ſum of the arches, to the tangent of half the difference of the ſame arches.

Demonſtration. In the plane triangle ABC (*fig.* 14.) it will be ſine A : BC : : ſine C : AB; then ſine A : ſine

sine C : : B C : AB, and sine A + sine C : sine A : : B C + A B : B C. Again, sine A — sine C : sine A : : B C — A B : B C; wherefore we have sine A + sine C : sine A — sine C : : B C + A B : B C — A B. But tang. $\frac{1}{2}\overline{A+C}$: tang. $\frac{1}{2}\overline{A-C}$: : B C + A B : B C — A B, by plane trigonometry; whence by equality of proportion we have sine A + sine C : sine A — sine C : : tang. $\frac{1}{2}\overline{A+C}$: tang. $\frac{1}{2}\overline{A-C}$. Now let the angles A B D, D B C, made by letting fall the perpendicular B D, be the given ones. Then it will be, as the sum of the co-sines of those angles is to their difference, so is the co-tangent of half the sum of those angles to the tangent of half their difference: for it has been already proved, that sine A + sine C : sine A — sine C : : tang. $\frac{1}{2}\overline{A+C}$: tang. $\frac{1}{2}\overline{A-C}$. But as the angles A and C are the complements of the given angles, it follows, that the co-sine A + co-sine C : cosine A — co-sine C : : co-tang. $\frac{1}{2}$ the angles $\overline{ABD+DBC}$: tang. of $\frac{1}{2}\overline{A-C}$, or tang. $\frac{1}{2}$ the difference of the angles A B D, D B C; for the difference of the angles at the base is equal to the difference of the angles made by the perpendicular.

Theorem 6. In any spherical triangle B E D (*fig.* 15.) it will be, as the co-tangent of half the sum of the two sides is to the tangent of half their difference, so is the co-tangent of half the base to the tangent of the distance (E H) of the perpendicular from the middle of the base.

Demonstration. It appears by corollary to theorem 2d, that cos. B E : cos. D E : : cos. B H : cos. D H : hence cos. B E ± cos. D E : cos. B E : : cos. B H ± cos. D H : cos. B H; whence cos. B E + cos. D E : cos. B E — cos. D E : : cos. B H + co-sine D H : co-sine B H — co-sine D H. But by the second part of the lemma, co-sine B E + co-sine D E : co-sine B E — cos. D E : : co-tang. $\frac{1}{2}\overline{BE+DE}$: tang. $\frac{1}{2}\overline{BE-DE}$; whence by equality of proportion we have co-tang. $\frac{1}{2}\overline{BE+DE}$: tang. $\frac{1}{2}\overline{BE-DE}$: : cos. B H + cos. D H : cos. B H — cos. D H. But, by the former part of the lemma, the cosine B H + cos. D H : cos. B H — cos. D H : : co-tang. $\frac{1}{2}$ B D : tang. H I; therefore tang. $\frac{1}{2}\overline{BE+DE}$: tang. $\frac{1}{2}\overline{BE-DE}$: : co-tang. $\frac{1}{2}$ B D : tang. H I.

Corollary. Since the last proportion by permutation becomes co-tang. $\frac{1}{2}\overline{BE+DE}$: co-tang. $\frac{1}{2}$ B D : : tang. $\frac{1}{2}\overline{BE-DE}$: tang. H I, it will follow, because the tangents of two arches are known to be inversely as their co-tangents, that the tangent of $\frac{1}{2}$ B D is to the tangent of $\frac{1}{2}\overline{BE+DE}$, as is the tangent of $\frac{1}{2}\overline{BE-DE}$, to the tangent of H I; that is, the tangent of $\frac{1}{2}$ the base is to the tangent of $\frac{1}{2}$ the sum of the sides, as the tangent of $\frac{1}{2}$ the difference of the sides is to the tangent of the distance of the perpendicular from the middle of the base.

Theorem 7. In any spherical triangle A E B (*fig.* 16.) it will be, as the co-tangent of half the sum of the angles at the base, is to the tangent of half their difference, so is the tangent of half the vertical angle to the tangent of the angle which the perpendicular E H makes with the line E K bisecting the vertical angle.

Demonstration. By corol. to theorem 3d, it will be, as the co-sine of the angle E A B, is to the co-sine of the angle A B E, so is the sine of the angle A E H to the sine of the angle B E H; whence by composition and division of ratios we have co-sine E A B + co-sine A B E : co-sine E A B — co-sine A B E : : sine A E H + sine B E H : sine A E H — sine B E H. But by the lemma we have co-sine E A B + co-sine A B E : co-sine E A B — cos. A B E : : co-tang. $\frac{1}{2}\overline{EAB+ABE}$: tang. $\frac{1}{2}\overline{EAB-ABE}$. And again, by the same lemma, sine A E H + sine B E H : sine A E H — sine B E H : : tang. $\frac{1}{2}$ A E B : tang. $\frac{1}{2}\overline{AEH-BEH}$; whence by writing these proportions in room of the former, we have the following; as the co-tangent of $\frac{1}{2}$ the angles at the base, viz. A + B, is to the tangent of $\frac{1}{2}$ their difference, so is the tangent of $\frac{1}{2}$ A E B to the tangent of the angle K E H, viz. that angle which the perpendicular E H makes with the line E K bisecting the vertical angle A E B.

The Solution of the cases of right-angled spherical Triangles.
See plate CXXXII. *fig.* 17.

Case	Given	Sought	Solution
1	The hyp. A C and one angle A	The opposite leg B C	As radius : sine hyp. A C : : sine A : sine BC (by the former part of theorem 1.)
2	The hyp. A C and one angle A	The adjacent leg A B	As radius : co-sine of A : : tang. A C : tang. A B (by the latter part of theorem 1.)
3	The hyp. A C and one angle A	The other angle C	As radius : co-sine of A C : : tang. A : co-tang. C (by theorem 5.)
4	The hyp. A C and one leg A B	The other leg B C	As co-sine A B : radius : : co-sine A C : co-sine B C (by theorem 2.)
5	The hyp. A C and one leg A B	The opposite angle C	As sine A C : radius : : sine A B : sine C (by the former part of theorem 1.)
6	The hyp. A C and one leg A B	The adjacent angle A	As tang. A C : tang. A B : : radius : co-sine A (by theorem 1.)
7	One leg A B and the adjacent angle A	The other leg B C	As radius : sine A B : : tang. A : tangent B C (by theorem 4.)
8	One leg A B and the adjacent angle A	The opposite angle C	As radius : sine A : : co-sine of A B : co-sine of C (by theorem 3.)
9	One leg. A B and the adjacent angle A	The hyp. A C	As co-sine of A : radius : : tang. A B tang. A C (by theorem 1.)
10	One leg B C and the opposite angle A	The other leg A B	As tang. A : tang. B C : : radius : sine A B (by theorem 4.)
11	One leg B C and the opposite angle A	The adjacent angle C	As co-sine B C : radius : : co-sine of A : sine C (by theorem 3.)
12	One leg B C and the opposite an gle A	The hyp. A C	As sine A : sine B C : : radius : sine A C (by theorem 1.)
13	Both legs A B and B C	The hyp. A C	As radius : co-sine A B : : cos. B C : cos. A C (by theorem 2.)
14	Both legs A B and B C	An angle, suppose A	As sine A B : radius : : tang. B C tang. A (by theorem 4.)
15	Both angles A and C	A leg, suppose A B	As sine A : co-sine C : : radius : co-sine A B (by theorem 3.)
16	Both angles A and C	The hyp. A C	As tang. A : co-tang. C : : radius : cos. A C (by theor. 5.)

Note. The 10th, 11th, and 12th cases are ambiguous; since it cannot be determined by the data, whether A B, C, and A C, be greater or less than 90 degrees each.

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The solution of the cases of oblique spherical Triangles.
See plate CXXXII. *fig.* 18, 19.

Case	Given	Sought	Solution
1	Two sides A C, B C, and an angle A opposite to one of them	The angle B opposite to the other	As sine B C : sine A :: sine A C : sine B (by cor. 1. to theorem 1.) Note, this case is ambiguous when B C is less than A C; since it cannot be determined from the data whether B be acute or obtuse.
2	Two sides A C, B C, and an angle A opposite to one of them	The included angle A C B	Upon AB produced (if need be, let fall the perpendicular C D: Then (by theorem 5,) radius : co-sine A C :: tang. A : co-tang. A C D; but (by cor. 2, to theorem 1.) as tang. B C : tang. A C :: co-sine A C D : cos. B C D. Whence A C B = A C D ± B C D is known.
3	Two sides A C, B C, and an angle opposite to one of them	The other side A B	As rad. : cos. A :: tang. A C : tan. A D (by theo. 1.) and (by cor. to theor. 2.) as cos. A C : co-sine B C :: co-sine A D : co-sine B D. Note, This and the last case are both ambiguous when the first is so.
4	Two sides A C, A B, and the included angle A	The other side B C	As radius : cosine A :: tang. A C : tang. A D (by theorem 1.) whence B D is also known: Then (by cor. to theorem 2.) as co-sine A D : co-sine B D :: co-sine A C : co-sine B C.
5	Two sides A C, A B, and the included angle A	Either of the other angles, suppose B	As radius : co-sine A :: tang. A C : tang. A D (by theorem 1.) whence B D is known; then (by cor. to theorem 4.) is sine B D : sine A D :: tang. A : tang. B.
6	Two angles A, A C B, and the side A C betwixt them	The other angle B	As radius : co-sine A C :: tang. A : co-tang. A C D (by theorem 5.) whence B C D is also known: Then (by cor. to theorem 3.) as sine A C D : sine B C D :: co-sine A : co-sine B.
7	Two angles A, A C B, and the side A C betwixt them	Either of the other sides, suppose B C	As radius : co-sine A C :: tang. A : co-tang. A C D (by theorem 5.) whence B C D is also known: Then, as co-sine B C D : co-sine A C D :: tang. A C : tang. B C (by cor. 2. to theorem 1.)
8	Two angles A, B, and a side A C opposite to one of them	The side B C opposite the other	As sine B : sine A C :: sine A : sine B C (by cor. 1. to theorem 1.)
9	Two angles A, B, and a side A C opposite to one of them	The side A B betwixt them	As radius : co-sine A :: tang. A C : tang. A D (by theorem 1.) and as tang. B : tang A :: sine A D : sine B D (by cor. to theorem 4.) whence A B is also known.
10	Two angles A, B, and a side A C opposite to one of them	The other angle A C B	As radius : co-sine A C :: tang. A : co-tang. A C D (by theorem 5.) and as co-sine A : co-sine B :: sine A C D : sine B C D (by cor. to theorem 3.) whence A C B is also known.
11	All the three sides A B, A C, and B C	An angle suppose A	As tang. $\frac{1}{2}$ A B : tang. $\frac{AC+BC}{2}$ :: tang. $\frac{AC-BC}{2}$: tang. D E, the distance of the perpendicular from the middle of the base (by cor. to theorem 6.) whence A D is known: Then, as tang. A C : tang. A D :: radius : co-sine A (by theor. 1.)
12	All the three angles A, B, and A C B	A side, suppose A C	As co-tang. $\frac{ABC+A}{2}$: tangent $\frac{ABC-A}{2}$ :: tang. $\frac{ACB}{2}$: tang. of the angle included by the perpendicular and a line bisecting the vertical angle; whence A C D is also known: Then (by theorem 5.) tang. A : co-tang. A C D :: radius co-sine A C.

Note, In letting fall your perpendicular, let it always be from the end of a given side and opposite to a given angle.

TRILLION, in arithmetic, the number of a billion of billions.

After billions we reckon by trillions, which makes a class of numeration, and is divided, like the other classes, into three places: thus we say, trillions; tens of trillions; hundreds of trillions, &c.

TRIM, *of a ship*, her best posture, proportion of ballast, and hanging of her masts, &c. for sailing. To find the trim of a ship, is to find the best way of making her sail swiftly, or how she will sail best. This is done by easing of her masts and shrouds; some ships sailing much better when they are slack, than when they are taut or fast: but this depends much upon experience and judgment, and the several trials and observations which the commander and other officers may make abroad.

TRIMACRUS, or TRIMACER, a foot, in ancient poetry, the same with the molossus.

TRIMMERS, in architecture, pieces of timber framed at right-angles to the joints, against the ways for chimneys, and well-holes for stairs.

TRINE, in astrology, the aspect or situation of one star with regard to another, when they are distant 120 degrees: it is noted with this character △.

TRINGA, in ornithology, a genus of birds belonging to the order of the scolopaces, the characters of which are these: the beak is of a cylindric figure, obtuse at the extremity, and in length about equal to the toes: the feet have each four toes, and they are connected.

To this genus belongs the ruff, the cinclus, the lapwing, the godwit, the tolk, grey plover, &c.

TRINGLE, in architecture, a name common to several little square members or ornaments, as reglets, listels, and platbands.

TRINGLE is more particularly used for a little member fixed exactly over every triglyph, under the plat-band of the architrave, from whence the guttæ or pendant drops hang down.

TRINITARIANS, those who are orthodox and believe in the Trinity: those who do not believe therein, being called Antitrinitarians.

TRINITARIANS also denote an order of religious instituted at Rome in the year 1198, under the pontificate of Innocent III. the founders of which were John de Matha, and Felix de Valois. John de Matha was born of noble parents in Provence, and took his degree of doctor in the university of Paris. Felix de Valois, so called from the country of Valois, lived as a hermit in a wood, in the diocese of Meaux. John de Matha, having had a vision of an angel presenting two captives to him, and thereupon resolving to devote himself to a religious life, joined himself with Felix de Valois, and these

these two saints lived together in the practice of virtue and all manner of austerities. One day, the story says, they observed a large white stag, who brought into the middle of the wood a red and blue cross. This wonderful sight, added to John de Matha's vision, made them conclude, that God required something in particular of them; and soon after an angel, in a dream, ordered them to go to Rome, where the pope would inform them what they must do. Innocent III. received them with great humanity, and, being convinced of their sanctity, gave them permission to establish a new order, whose principal end should be to labour for the deliverance of captives, who groaned under the tyranny of the infidels. The same pope gave them a habit, which was a white gown ornamented with a red and blue cross, in memory of the apparition of the stag; and gave this new order the title of the Holy Trinity.

John de Matha and Felix de Valois being returned into France, king Philip Augustus consented to the establishment of their order in that kingdom. Accordingly a convent was built in the place where they had the vision of the stag, and was from thence called Cerfroy. This monastery was endowed by Margaret countess of Burgundy, for the maintenance of twenty religious. John de Matha, seeing his order established, sent John Anglicus and William Scot, two Englishmen, to Morocco, in Africa, to treat with Miramolin for the redemption of poor Christian captives. This negotiation succeeded so well, that, in the year 1200, they redeemed 186 slaves. The same year, they had a convent given them in the territory of Honscott in Flanders, and another at Arles in Provence. Afterward John de Matha took a journey into Spain, where he prevailed upon the kings and princes of that country to make several settlements for the redemption of Christian captives. In the mean time, Felix de Valois gained an establishment at Paris, in a place where was a chapel dedicated to St. Mathurin; from whence this order had the name of Mathurins. After the death of the two holy founders, pope Honorius III. confirmed the order, and their rule was approved by his successor Clement IV. in 1267. At first they were not permitted to eat any flesh meat, and, when they travelled, they were to ride only upon asses. But their rule was corrected and mitigated by the bishop of Paris, and the abbots of St. Victor and St. Genevieve: and they were allowed to eat meat, and to use horses.

This order possesses two hundred and fifty convents, divided into thirteen provinces: six of these are in France; namely, France, Normandy, Picardy, Champagne, Languedoc, and Provence: three are in Spain; namely, New Castile, Old Castile, and Arragon: one in Italy, and one in Portugal. There was formerly the province of England, where this order had forty-three houses; that of Scotland, where it had nine; and that of Ireland, where it had fifty-two; besides a great number of monasteries in Saxony, Hungary, Bohemia, and other countries. The convent of Cerfroy, in France, is head of the order.

In 1573, a reform of this order was began by Julian de Nantonville and Claude Aleph, two hermits of St. Michael, who obtained leave of the pope to take the habit of the Trinity; whereupon their hermitage was converted into a house of the order. The principal articles of the reform were, that they should observe the primitive rules approved by Clement IV. should abstain from flesh, use woollen shirts, and have matins at midnight. This reform was not embraced by the whole order, till 1635, when Cardinal Rochefoucault, by order of pope Urban VIII. introduced it into all the houses of the Trinitarians. Those of Spain, in 1594, added to the reform the going bare-footed; for which reason, in that country, they began to be called bare-footed Trinitarians. There are also bare-footed Trinitarians in France, established by F. Jerom Hallies.

There are also nuns of the Trinitarian order, in Spain, established by John de Matha himself, who built them a convent in 1201, under the direction of the infanta Constantia, daughter of Peter II. king of Arragon; who was the first religious, and the first superior of the order. And, in 1612, Frances de Romero, daughter of Julian de Romero, lieutenant general of the Spanish army, founded a convent of bare-footed Trinitarian nuns at Madrid.

TRINITY, *Trinitas*, in theology, the ineffable mystery of three persons in one God, Father, Son, and Holy Spirit. See GOD, &c.

The doctrine of the Trinity, as professed in the Christian church, is as follows; that there is but one God in three distinct persons, Father, Son, and Holy Ghost; *person* signifying the same as *essence*, with a particular manner of subsistance, which the Greek fathers call hypostasis, taking it for the incommunicable property that makes a person. The Father, Son, and Holy Ghost are believed to be three distinct persons in the divine nature, because the scriptures in speaking of these three distinguish them from one another, as we use in common speech to distinguish three several persons. There are many instances to this purpose; particularly the form of administring the sacrament of baptism, which runs in the name of the Father, the Son, and the Holy Ghost: and that solemn benediction, with which St. Paul concludes his second epistle to the Corinthians: "The grace of our Lord Jesus Christ, &c." and the three witnesses in heaven, mentioned by St. John. Each of these three persons are affirmed to be God, because the names, properties, and operations of God are, in the holy scripture, attributed to each of them.

The divinity of the Father is undisputed. That of the Son is proved from the following texts, among many others. St. John says, "The Word was God;" St. Paul, "That God was manifested in the flesh; that Christ is over all, God blessed for ever." Eternity is attributed to the Son: "The Son hath life in himself:" perfection of knowledge: "As the Father knoweth me, so know I the Father." And we are commanded, "to honour the Son, as we honour the Father." The divinity of the Holy Ghost rests upon the following proofs, among others: Lying to the Holy Ghost, is called "lying to God:" because Christians are the temples of the Holy Ghost, they are said to be the "temples of God." "His teaching all things; his guiding into all truth; his telling things to come; his searching all things, even the deep things of God, &c." are adduced as plain characters of his divinity. Besides, he is joined with God the Father, as an object of faith and worship, in baptism, and the apostolical benediction.

This doctrine is called a mystery, because we are not able to comprehend the particular manner of the existence of the three persons in the divine nature. But tho' a doctrine be above reason, it is not therefore contrary to reason; and the perfections of the divine nature being infinite, must consequently be above our reach. As to the seeming contradiction of a Unity in Trinity and Trinity in Unity, that is, of One being Three and Three One; the answer is, that it is not affirmed, they are One and Three in the same respect; that the divine essence can be but one, and therefore there can be no more Gods than one: but because the scriptures, which assure us of the unity of the divine essence, do likewise with the Father join the Son and Holy Ghost, in the same attributes, operations, and worship, therefore they are capable of number as to their relation to each other, though not as to their essence, which is but one.

The school divines have taken great pains to perplex this doctrine with nice distinctions, and an unintelligible jargon. Thus they tell us, there is, in God, one Essence, two Processions, three Persons, four Relations, five Notions, and the Perichoresis, Circumincession, or Mutual in-dwelling of the three persons. The Son, they say, proceeds from the Father by generation, but the Holy Ghost by spiration: they talk of paternity and filiation, and distinguish between active and passive spiration; with much cant of this sort, which cannot easily be explained or understood.

It is evident from ecclesiastical history, that the devotions of the ancient church were paid to every person of the Trinity. St. Stephen, the proto-martyr, breathed his last in a prayer to Christ; and St. Paul always baptised in the name of Christ.

In the second century, Pliny, who took the confession of some revolting Christians, tells us, they declared to him, that they used to meet on a certain day, before

it was light, and, among other parts of their worſhip, ſing a hymn to Chriſt, as their God. Not long after this, lived Polycarp, who joins God the Father and the Son together, in his prayers for grace and benediction upon men. Soon after lived Juſtin Martyr, who, to wipe off the charge of atheiſm brought againſt the Chriſtians, declares, that they worſhipped the God of righteouſneſs, and his Son, as alſo the Holy ſpirit of prophecy. Minucius Felix, in anſwer to an objection, that the Chriſtians worſhipped a crucified man, ſays, He, whom they worſhipped, was God, and not a meer mortal man. Irenæus, ſpeaking of the miracles wrought by the Chriſtians in his time, aſſures us, they were done, not by magic or enchantment, but by invocation of the name of Chriſt. To theſe may be added the teſtimonies of Theophilus biſhop of Antioch, Clemens Alexandrinus, and Tertullian, the laſt writer of the ſecond age. In the third century, we have an illuſtrious teſtimony of the worſhip of Chriſt, as God, in the fragments of Caius, a Roman preſbyter, preſerved by Euſebius. And Origen, in particular, aſſerts the worſhip of Chriſt, againſt the common objection, renewed by Celſus, that the Chriſtians worſhipped one who had but lately appeared in the world. Add to theſe the teſtimonies of St. Cyprian, Arnobius, and Lactantius. As that age abounded in martyrs, ſo thoſe holy men uſually directed their laſt prayer to Chriſt, in imitation of St. Stephen; inſtances of which practice are innumerable.

That they paid divine worſhip to the Holy Ghoſt alſo, appears from the above-cited teſtimonies. For Polycarp's doxology is to the whole Trinity; and Juſtin Martyr declares, that the object of their worſhip was the whole Trinity. To which may be added the plain teſtimony of Origen, who, comparing the practice of heathens and Chriſtians, ſays, The former, having forſaken the Creator, worſhipped the creature, but the latter worſhipped and adored no creature, but only the Father, Son, and Holy Spirit. In Tertullian's time, the worſhip of the Holy Ghoſt was ſo common in the church, that Praxeas, and other Unitarians, charged the catholics with Tritheiſm, or the worſhip of three Gods, upon that account.

Chriſtians, in many places, have fallen into the abſurdity, if not blaſphemy, of making viſible repreſentations of the myſtery of the Trinity. Biſhop Burnet tells us, that before the Reformation, it was uſual, in England, to have pictures of the Trinity. God the Father was generally repreſented in the ſhape of an old man, with a triple crown, and rays about his head. The Son, in another part of the picture, looked like a young man, with a ſingle crown on his head, and a radiant countenance. The bleſſed virgin was between them, in a ſitting poſture; and the Holy Ghoſt, under the appearance of a dove, ſpread his wings over her. This picture, he tells us, is ſtill to be ſeen in a prayer-book, printed in the year 1526, according to the ceremonial of Saliſbury. Skippon tells us, there is, at Padua, a repreſentation of the Trinity, being the figure of an old man, with three faces and three beards.

Many of the heathens ſeem to have had a notion of a Trinity in the Godhead; and Plato and his followers ſpeak of it in ſuch terms, that the primitive Fathers have been accuſed of borrowing the very doctrine from the Platonic ſchool. This point is treated at large in Cudworth's Intellectual Syſtem.

The ſeveral Anti-trinitarian hereſies may be ſeen under their reſpective articles. See ARIANS, SABELIANS, SOCINIANS, &c.

TRINITY-SUNDAY, a feſtival of the Chriſtian church, obſerved on the Sunday next after Whitſunday in honour of the Holy and undivided Trinity. The obſervation of this feſtival was firſt enjoined in the council of Arles, anno 1260.

TRINITY-HOUSE, a ſociety founded in the year 1515, by Sir Thomas Spert, Knt. commander of the great ſhip Henry Grace de Dieu, and comptroller of the navy to Henry VIII. for the regulation of ſeamen, and the convenience of ſhips and mariners on our coaſt, and incorporated by the above-mentioned prince, who confirmed to them not only the ancient rights and privileges of the company of mariners of England, but their ſeveral poſſeſſions at Deptford; which, together with the grants of queen Elizabeth and king Charles II. were alſo confirmed by letters patent of the firſt of James II. in 1685, by the name of "The maſter, wardens and aſſiſtants of the guild or fraternity of the moſt glorious and undivided Trinity, and of St. Clement, in the pariſh of Deptford Stroud, in the county of Kent."

This corporation is governed by a maſter, four wardens, eight aſſiſtants, and eighteen elder brethren; but the inferior members of the fraternity, named younger brethren, are of an unlimited number; for every maſter, or mate, expert in navigation may be admitted as ſuch; and theſe ſerve as a continual nurſery to ſupply the vacancies among the elder brethren, when removed by death, or otherwiſe.

The maſter, wardens, aſſiſtants, and elder brethren, are by charter inveſted with the following powers:

1. That of examining the mathematical children of Chriſt's hoſpital. 2. The examination of the maſters of his majeſty's ſhips; the appointing pilots to conduct ſhips in and out of the river Thames; and the amercing all ſuch as ſhall preſume to act as maſter of a ſhip of war or pilot, without their approbation, in a pecuniary mulct of twenty ſhillings. 3. The ſettling the ſeveral rates of pilotage, and erecting light-houſes, and other ſea-marks upon the ſeveral coaſts of the kingdom, for the ſecurity of navigation; to which light-houſes all ſhips pay one halfpenny a ton. 4. The granting licenſes to poor ſeamen, not free of the city, to row on the river Thames, for their ſupport, in the intervals of ſea-ſervice, or when paſt going to ſea. 5. The preventing of aliens from ſerving on board Engliſh ſhips, without their licenſe, upon the penalty of five pounds, for each offence. 6. The puniſhing ſeamen for deſertion, or mutiny, in the merchants ſervice. 7. The hearing and determining the complaints of officers and ſeamen in the merchants ſervice; but ſubject to an appeal to the lords of the Admiralty, or the judge of the court of Admiralty.

To this company belongs the ballaſt office, for clearing and deepening the river Thames, by taking from thence a ſufficient quantity of ballaſt, for the ſupply of all ſhips that ſail out of that river; in which ſervice ſixty barges with two men in each, are conſtantly employed; and all ſhips that take in ballaſt pay them one ſhilling a ton, for which it is brought to the ſhip's ſides.

In conſideration of the great increaſe of the poor of this fraternity, they are by their charter impowered to purchaſe in mortmain lands, tenements, &c. to the amount of five hundred pounds per annum; and alſo to receive charitable benefactions of well diſpoſed perſons, to the like amount of five hundred pounds per annum, clear of reprizes.

There are annually relieved by this company about three thouſand poor ſeamen, their widows, and orphans, at the expence of about ſix thouſand pounds.

They commonly meet to chooſe their maſter at their houſe at Deptford; but are not obliged to do it there. Their meetings are generally on Wedneſdays and Saturdays, at their houſe in Water lane, Thames ſtreet; but their courts are not conſtantly fixed to a ſet time.

Fraternity of the TRINITY, a religious ſociety inſtituted at Rome by St. Philip Neri, in 1548. Theſe religious were appointed to take care of the pilgrims who came to viſit the tombs of St. Peter and St. Paul. The ſociety originally conſiſted of only fifteen religious, who aſſembled on the firſt Sunday of every month, in the church of St. Saviour del Campo, to hear the exhortations of the founder; after whoſe death pope Paul IV. gave the fraternity the church of St. Benedict, near which they have ſince built a large hoſpital for the reception of pilgrims. The fraternity is one of the moſt conſiderable in Rome, and moſt of the nobility of both ſexes have been members thereof.

TRINOMIAL, or TRINOMIAL-ROOT, in mathematics, is a root conſiſting of three parts connected together by the ſigns + or −, as $x+y+z$, or $a+b-c$.

TRIO, in muſic, a part of concert wherein three perſons ſing; or more properly a muſical compoſition conſiſting of three parts. Trios are the fineſt kinds of compoſition, and theſe are what pleaſe moſt in concerts.

TRIOCTILE,

TRIOCTILE, in aſtrology, an aſpect or ſituation of two planets with regard to the earth, when they are three octants or eight parts of a circle, that is, 135° diſtant from each other. This aſpect, which ſome call the ſeſquiquadrans, is one of the new aſpects ſuperadded to the old ones by Kepler.

TRIONES, in aſtronomy, a ſort of conſtellation or aſſemblage of ſeveral ſtars in the urſa minor, commonly called Charles's wain.

TRIONUM, in botany, a genus of plants, the corolla whereof conſiſts of five patent petals, vertically cordated, and united together at the baſe: the fruit is an ovated quinquangular capſule, conſiſting of five cells, and containing five valves: the ſeeds are numerous, and kidney-ſhaped.

TRIOPTERIS, in botany, a genus of plants, the corolla whereof conſiſts of ſix oval, erecto-patulous, equal and permanent petals, ſurrounded by three others ſmaller than themſelves, but equal to one another: there is no pericarpium: the ſeeds are three, erect and carinulated at the back; each of them has externally at its baſe an ala, and at its apex two; theſe ala are what in the flowering ſtate of the plant appear to be petals, but they are not truly ſuch.

TRIOSTEUM, in botany, a genus of plants, the flower of which has a permanent empalement of one leaf, cut into five ſegments; it has a tubulous flower of one petal, with a ſhort brim, cut into five parts, which ſtand erect, and five ſlender ſtamina the length of the tube, terminated by oblong ſummits, with a roundiſh germen, ſupporting a cylindrical ſtyle, crowned by a thick ſtigma. The germen afterward becomes an oval berry with three cells, each including one hard, three-crowned, obtuſe ſeed.

There are two ſpecies of this plant. The firſt ſort grows naturally in the woods in ſeveral parts of North America; and the root is compoſed of thick fleſhy fibres, which are contorted and rough, from which ſpring ſeveral ſtrong herbaceous ſtalks a foot and a half high, garniſhed at each joint by two oblong broad leaves, ſitting cloſe to the ſtalk. From the boſoms of theſe come out the flowers in whorls, ſitting very cloſe to the ſtalks; the empalements are cut into five ſegments. The flowers are ſmall, tubulous, of a dark red colour, and cut ſlightly at the brim into five obtuſe ſegments, and are ſucceeded by roundiſh berries, which turn yellow when ripe, having three cells, in each of which is contained one hard ſeed. The root is perennial, but the ſtalks decay every autumn.

The ſecond ſort differs from the firſt in its leaves, being longer and narrower. The flowers ſtand ſingle upon ſhort foot-ſtalks, but two at each joint, whereas the other has many growing in whorls round the ſtalks; but the roots of both are indifferently uſed in America by the title of Dr. Tinkar's weed.

Both theſe plants are natives of Virginia, and ſome other northern parts of America, where their roots have been frequently uſed as an emetic, and are commonly called ipecacuana. One of the firſt perſons who brought the roots into uſe was Dr. Tinkar, from whence many of the inhabitants have called them by the name of Dr. Tinkar's weed, as hath been already obſerved. The leaves of the firſt ſort greatly reſemble thoſe of the true ipecacuana, but the roots are of a different form; but ſo far as I can judge, ſays Mr. Miller, by the imperfect fruit of a ſpecimen in my collection of the true ipecacuana, as alſo by the figure and deſcription given by Piſo in his hiſtory of Braſil, it ſeems to belong to this genus.

The firſt ſort grows on low marſhy grounds, near Boſton in New-England, very plentifully, where the roots are taken up every year, and are continued in uſe amongſt the inhabitants of Boſton.

This plant is preſerved in ſeveral curious gardens in England, and is hardy enough to thrive in the open air; but it ſhould be planted on a moiſt, light, ſoil; for if it is on a dry ground, there muſt be care taken to water the plants conſtantly in dry weather, otherwiſe they will not thrive.

It may be propagated by ſeeds, which ſhould be ſown in autumn, on a border of light earth, expoſed to the morning ſun; for if the ſeeds are ſown in the ſpring, they will remain in the ground a whole year before the plants will come up, ſo that during this time the border muſt be conſtantly kept clear from weeds; the following ſpring, when the plants appear, they ſhould be duly watered in dry weather, which will greatly promote their growth; but if the ſeeds are ſown in autumn, the plants will come up the following ſpring, and muſt be conſtantly kept clean from weeds, which, if permitted to grow amongſt them, will ſoon over-bear the plants while they are young, and either quite deſtroy them, or ſo much weaken them, that they will not recover in a long time.

The plants may remain in this ſeed-border until the Michaelmas following, when they ſhould be carefully taken up, and tranſplanted where they are deſigned to remain. Some of them ſhould be planted in pots, that they may be ſheltered in winter, leſt thoſe which are in the full ground ſhould be deſtroyed by ſevere froſt.

They may be alſo propagated by parting of the roots. The beſt ſeaſon for this work is in the ſpring, juſt before the plants begin to ſhoot, which is commonly about the middle or latter end of March; but in doing of this, the roots muſt not be parted too ſmall, for that will prevent their flowering ſtrong.

Theſe plants perfect their ſeeds in this country every year, if ſown in autumn as ſoon as they are ripe, which is the beſt way to propagate them. The ſeedling plants will not flower until the third year, and then they are ſeldom ſo ſtrong as the older plants.

TRIP, a ſea term. A ſhip is ſaid to bear her top-ſails a-trip, when ſhe carries them hoiſted up to the higheſt.

TRIPARTITE, ſomething divided into three parts, or made by three parties, as indenture tripartite, &c.

TRIPARTITION, a diviſion by three, or the taking the third part of any number or quantity.

TRIPELAS, in natural hiſtory, earths compoſed of ſimilar particles, naturally dry, and of rough duſty ſurfaces, but ſomewhat more firmly coherent than the ochres, compoſed of fine but hard particles, and not readily diffuſible in water. Of this genus of earths authors make five ſpecies, which may be reduced to the yellowiſh and the reddiſh; for an account of which, ſee the article TRIPOLI.

TRIPENTAHÆDRIA, in natural hiſtory, the name of a genus of ſpars, compoſed of thrice five planes, being made of a pentangular column, terminated at each end by a pentangular pyramid. Of this genus we have only one ſpecies: this has a moderately long column, and very ſhort and broad pyramids; it is found in Derbyſhire, Yorkſhire, and Cornwall, and is frequently about Goſſelaer, in Saxony.

TRIPHTHONGUE, in grammar, an aſſemblage or concourſe of three vowels in the ſame ſyllable, as *quæ*.

TRIPLE, in muſic, is one of the ſpecies of meaſure or time.

Triple-time conſiſts of many different ſpecies, of which there are in general four, each of which has its varieties. The common name triple is taken hence, that the whole half of the bar is diviſible into three parts, and is beaten accordingly. The firſt ſpecies is called the ſimple triple, wherein the meaſure is equal to three ſemibreves, three minims, three crotchets, three quavers, or three ſemiquavers, which are marked thus, $\frac{3}{1}$, $\frac{3}{2}$, $\frac{3}{4}$, $\frac{3}{8}$, $\frac{3}{16}$, but the laſt is not much uſed, except in church muſic. In all theſe the meaſure is divided into three equal parts or times, called thence triple-time, or the meaſure of three times; of which two are beat down, and the third up. The ſecond ſpecies is the mixed triple; its meaſure is equal to ſix crotchets, or ſix quavers, or ſix ſemiquavers, and accordingly is marked $\frac{6}{4}$, or $\frac{6}{8}$ or $\frac{6}{16}$; but the laſt is ſeldom uſed. The meaſure here is uſually divided into equal parts or times, of which one is beat down and one up; but it may alſo be divided into ſix times, of which the firſt two are beat down and the third up, then the next two down and the laſt up; that is, each half of the meaſure is beat like the ſimple triple,

triple, on which account it may be called the compound triple, and becauſe it may be thus divided either into two or ſix times, that is, two triples, it is called mixed, and by ſome the meaſure of ſix times. The third ſpecies is the compound triple, conſiſting of nine crotchets or quavers, or ſemi-quavers, marked $\frac{9}{4}$, $\frac{9}{8}$, $\frac{9}{16}$; the firſt and laſt are little uſed: ſome alſo add $\frac{9}{1}$, $\frac{9}{2}$, which are never uſed; ſome add alſo other two, viz. ſix ſemi-breves and ſix minims, marked $\frac{6}{1}$ or $\frac{6}{2}$, but theſe are not in uſe. This meaſure is divided into three equal parts or times, whereof two are beat down and one up; or each third part may be divided into three times, and beat like the ſimple triple, on which account it is called the meaſure of the nine times. The fourth ſpecies is a compound meaſure of the ſecond ſpecies, containing twelve crotchets or quavers, or ſemi-quavers, marked $\frac{12}{4}$, $\frac{12}{8}$, $\frac{12}{16}$, to which ſome add $\frac{12}{1}$ and $\frac{12}{2}$, which are never uſed; nor are the firſt and third much uſed; eſpecially the latter. The meaſure here may be divided into two times, and beat one down and one up; or each half may be divided and beat as the ſecond ſpecies, either by two or three, in which caſe it will make in all twelve times; and hence it is called the meaſure of twelve times. The French and Italian authors make a great many more ſpecies and diviſions of triple-time, unknown, or at leaſt unregarded, by our Engliſh muſicians, and therefore not neceſſary to be dwelt on here.

TRIPLICATE RATIO, the ratio which cubes bear to one another. See CUBE.

This ratio is to be diſtinguiſhed from triple ratio, and may be thus conceived. In the geometrical proportions 2, 4, 8, 16, 32, as the ratio of the firſt term (2) is to the third (8) duplicate of that of the firſt to the ſecond, or of the ſecond to the third, ſo the ratio of the firſt to the fourth is ſaid to be triplicate of the ratio of the firſt to the ſecond, or of that of the ſecond to the third, or of that of the third to the fourth, as being compounded of three equal ratios.

TRIPLICITY, or TRIGON, among aſtrologers, is a diviſion of the ſigns according to the number of the elements, each diviſion conſiſting of three ſigns. Triplicity is frequently confounded with trine aſpect, tho' ſtrictly ſpeaking the two are very different things; as triplicity is only uſed with regard to the ſigns, and trine, on the contrary, with regard to the plants. The ſigns of triplicity are thoſe which are of the ſame nature, and not thoſe which are in trine aſpect. Thus Leo, Sagittarius, and Aries, are ſigns of triplicity, becauſe thoſe ſigns are by theſe writers all ſuppoſed fiery.

TRIPOD, *Tripos*, in antiquity, a famed ſacred ſeat or ſtool, ſupported by three feet, whereon the prieſts and ſibyls were placed to render oracles. It was on the tripod that the gods were ſaid to inſpire the Pythians with that divine fury and enthuſiaſm wherewith they were ſeized at the delivery of their predictions.

TRIPOLI, a ſtate of Africa, which including Barca, is bounded by the Mediterranean-ſea on the north, by Egypt on the eaſt, by Nubia and Biledulgerid on the ſouth, and by Tunis on the weſt; extending along the ſhore of the Mediterranean from the north-weſt to the ſouth-eaſt about a thouſand miles, but ſcarce two hundred miles broad in any place. The city of Tripoli, being the capital of this ſtate, is ſurrounded with a wall and other fortifications: eaſt long. 14 deg. 30 min. north lat. 33 deg. 30 min.

TRIPOLI, in natural hiſtory, the name of an earthy ſubſtance, much uſed by the lapidaries to poliſh ſtones, and by the braziers, and other the like artiſts, to clean metalline veſſels. It is of two kinds, the yellowiſh, and reddiſh-white; the yellowiſh white kind is called by authors alana gleba, tripolis and terra tripolitana; this is the produce of Germany, Saxony, and France; there is alſo of it in the neighbourhood of Venice, but it is found in greateſt plenty in many parts of Africa. It is found a dry hard earth, of a very pale yellowiſh-white, of a firm texture, and moderately heavy; it is ſometimes found of itſelf, conſtituting a ſtratum; but it is more frequently met with in detached pieces among ſtrata of other matter. It is of a rough, irregular, duſty ſurface; it adheres ſlightly to the tongue, is dry, hard, and harſh to the touch, is not to be broken between the fingers, and ſlightly ſtains the hands: it makes no efferveſcence with aqua fortis, and makes a ſlight hiſſing noiſe on being thrown into water. The reddiſh tripoli is of our own production, though not peculiar to our country; it is found in great abundance on Mendip-hills in Somerſetſhire, and not leſs plentifully in many parts of Germany. This is well known in the ſhops as a ſubſtance of great uſe in poliſhing braſs, but is not applied to any of the other uſes of the yellowiſh kind: this, like the former, is moſt frequently found in detached maſſes, and while in the earth is tolerably ſoft, and eaſily falls into flakes. When dry it becomes of a conſiderable hardneſs, and is of a fine pale reddiſh-white, of a looſe open texture, compoſed of a multitude of extremely thin plates or flakes laid evenly on one another, and conſiderably heavy; it is of a ſmooth and ſomewhat gloſſy ſurface; it adheres very firmly to the tongue, is dry and harſh to the touch, too hard to be broken between the fingers, and does not ſtain the hands: it makes no efferveſcence with acids, and burns to a paler colour, with ſome additional hardneſs.

TRIPPING, in heraldry, denotes the quick motion of all ſorts of deer, and of ſome other creatures, repreſented with one foot as it were on a trot.

TRIPTOTES, *Triptota*, in grammar, defective nouns which have only three caſes; ſuch is *mele*, *tempe*, *grates*, *prece*, &c.

TRIQUETROUS, among botaniſts, expreſſes a fruit or leaf that has three ſides or faces all flat. This leaf is uſually ſubulated, or grows gradually ſmaller from the baſe to the point.

TRIREME, or TRIREMIS, in antiquity, a gally with three ranks of oars on a ſide.

TRISECTION, or TRISSECTION, the dividing a thing into three. The term is chiefly uſed in geometry, for the diviſion of an angle into three equal parts. The triſection of an angle geometrically, is one of thoſe great problems whoſe ſolution has been ſo much ſought by mathematicians for theſe two thouſand years, being in this reſpect on a footing with the quadrature of the circle, and the duplicature of the cube angle.

TRISMEGISTUS, an epithet or ſurname given to one of the two Hermeſes, or Mercuries, kings of Thebes in Egypt, who is ſaid to be contemporary with Moſes.

TRISOLYMPIONICA, amongſt the antients, a perſon who had thrice borne away the prize at the Olympic games; theſe had great privileges and honours paid them.

TRISPAST, *Triſpaſton*, in mechanics, a machine with three pullies, or an aſſemblage of three pullies for raiſing of great weights.

TRISYLLABLE, or TRISSYLLABLE, in grammar, a word conſiſting of three ſyllables.

TRITE, in muſic, the third muſical chord in the ſyſtem of the ancients.

TRITICEA, the name whereby ſome authors call the triticum. See the next article.

TRITICUM, in botany, a genus of plants, the corolla whereof conſiſts of two valves, nearly equal in ſize, and of the bigneſs of thoſe of the cup. The exterior valve is bellied with an obtuſe end, terminated by a point; the interior valve is plane. The corolla ſerves inſtead of a pericarpium, incloſing the ſeed, which is ſingle, obtuſe, and furrowed on one ſide.

This genus comprehends the common wheat, the ſpelt-corn, and couch-graſs. See WHEAT, &c.

TRITON, in ichthyology, a genus of fiſh, the body of which is oblong, the roſtrum at the mouth of a ſpiral form, the tentacula fourteen in number, and twelve of them cheliferous.

TRITON, in poetry, a ſea-demi-god, held by the ancients to be an officer or trumpeter of Neptune, attending on him, and carrying his orders and commands from ſea to ſea.

The poets repreſent him as a half man, half-fiſh, terminating in a dolphin's tail, and bearing in one hand a ſea-ſhell, which ſerves as a trumpet. Some of the antients make him the ſon of Neptune and the nymph Salacia; Heſiod, of Neptune and Amphitrite; Neumenius, in his book De Piſcationibus, makes him the ſon of Oceanus and Tethys; and Lycophron, the ſon of Nereus. But, though Heſiod and the mythologiſts only ſpeak of one Triton, the poets have imagined ſeveral,

giving ſome of them for trumpeters to all the ſea-gods, particularly to Neptune and Venus; accordingly they were frequently introduced on the antient theatres, in the Naumachia.

TRITONE, *Tritono*, in muſic, a falſe concord conſiſting of three tones, or a greater third and a greater tone.

Its ratio or proportion in numbers is of 45 to 32. In dividing the octave we find on one ſide the falſe fifth, and the tritone on the other.

The tritone is a kind of redundant fourth, conſiſting of three tones, whence its name; or more properly of two tones, with a greater ſemi-tone and a leſſer, as of *ut* to *fa*, ſharp; of *fa* to *ſi*, flat, &c. But it is not, as many imagine, a greater fourth, for the fourth is a perfect interval, which does not admit of any majority or minority; nor muſt the tritone be confounded with the falſe fifth, for the tritone only comprehends four degrees, viz. *ut*, *re*, *mi*, *fa*, ſharp; whereas the falſe fifth comprehends five, viz. *fa*, ſharp, *ſol*, *la*, *ſi*, *ut*. Beſides that, among the ſix ſemi-tones, which compoſe the tritone chromatically, there are three greater and three leſſer; whereas, among the ſix ſemi-tones, which compoſe the falſe fifth, there are only two leſſer and four greater.

TRITURATION, *Tritura*, in pharmacy, the act of reducing a ſolid body into a ſubtile powder; called alſo levigation and pulverization. See LEVIGATION and PULVERIZATION.

This is principally employed to reduce hard ſubſtances to fine powders, either by the mortar, or by way of levigation on a marble: there is little difficulty in this, beſides the labour. Trituration has a great ſhare in ſome inſtances, in raiſing or depreſſing the efficacy of what comes under its management; for in grinding all thoſe bodies, whoſe efficacy conſiſts in the peculiar ſhape and points of their component parts, the more and finer they are broke, the leſs they will operate: thus may calomel be rendered much gentler, and made capable of being given in much larger quantities, only by long rubbing in a glaſs mortar; for the continual triture has the ſame effect upon it, as repeated ſublimation, which is only breaking of the ſaline ſpicula more and more, until it becomes almoſt plain mercury. But in reſinous ſubſtances, particularly thoſe which are purgative, as jalap, ſcammony, &c. the finer the powder they are reduced into, the greater their efficacy is likely to be. As the ſenſe which the ſtomach and bowels have of them, is in proportion to their contacts, therefore the more the ſame quantity is divided, the farther will it diffuſe itſelf, and vellicate the fibres; that is, in other words, it will work the more.

TRITURATION, is alſo uſed in medicine for the action of the ſtomach on the food, whereby it is fitted for nouriſhment.

TRIUMFETTA, in botany, a genus of plants, the flower of which has no empalement, but it has five linear, erect, obtuſe petals, which turn inward; it has ten awl-ſhaped riſing ſtamina the length of the petals, terminated by ſingle ſummits, and a roundiſh germen, ſupporting a ſtyle the length of the ſtamina, crowned by an acute bifid ſtigma. The germen afterward becomes a globular capſule, ſet with long prickles on every ſide, having four cells, each containing one ſeed, which is convex on one ſide, and angular on the other.

There are two ſpecies of this plant. The firſt ſort grows naturally in Jamaica and moſt of the other iſlands in the Weſt-Indies; it riſes with an upright ſtem to the height of ſix or ſeven feet, which becomes ligneous toward the bottom, dividing upward into four or five branches, garniſhed with leaves, placed alternately, divided almoſt into three lobes toward the top, ending in acute points; they are covered with a ſoft brown down on their under ſide, but their upper is of a yellowiſh green; their borders are acutely but unequally ſawed, ſtanding upon foot-ſtalks an inch long. The branches are terminated by long ſpikes of flowers, and from the ſide of the ſtalk come out ſeveral ſmall cluſters. The flowers are ſmall, the petals narrow, of a yellow colour; theſe are ſucceeded by burry capſules, ſomething like thoſe of the agrimony, but rounder; the prickles are longer than thoſe, and are placed on every ſide. This plant generally flowers here in July and Auguſt, and in warm ſeaſons the ſeeds do ſometimes ripen.

The ſecond ſort grows naturally in India; it is an annual plant, riſing near three feet high; the ſtalks are ligneous, branching out toward the top into three or four ſlender branches, garniſhed with entire leaves, ſawed on their edges, ending in acute points, and are terminated by ſmall cluſters of pale yellow flowers ſtanding upon pretty long foot-ſtalks. The empalements of the flowers are cut into five narrow ſegments, but ſoon fall off; the flower has five erect petals, and generally ten ſlender ſtamina, terminated by roundiſh ſummits, with a roundiſh germen, ſupporting one hairy ſtyle, crowned by a ſingle ſtigma. The germen afterward becomes a round prickly capſule with four or five cells, each including one ſeed.

Theſe ſorts are both propagated by ſeeds, which muſt be ſown on a hot-bed early in the ſpring; and when the plants come up, and have four or five leaves, they ſhould be each tranſplanted into a ſeparate pot, and plunged into a moderate hot-bed of tanners bark, ſhading them from the ſun until they have taken new root; then they muſt be treated in the ſame manner as other tender exotic plants. During the ſummer-ſeaſon the plants may remain in this hot-bed, but in autumn the firſt muſt be removed into the ſtove, and plunged into the bark-bed. If the plants live through the winter, they will flower the following ſummer, ſo will ripen their ſeeds in autumn; but they may be continued two years, provided they are carefully managed.

The ſecond ſort is annual; ſo, if the plants are brought forward early in ſummer, they will flower in autumn, but muſt be removed into a ſtove to perfect the ſeeds, which ſeldom ripen in England before Chriſtmas.

TRIUMPH, *triumphus*, a ſolemnity practiſed by the ancient Romans, to do honour to a victorious general.

There were two ſorts of triumphs, the greater and the leſſer, particularly called ovation: of theſe, the triumph was much the more ſplendid proceſſion. None were capable of this honour, but the dictator, conſuls, and prætors; though there are examples to the contrary, as particularly in Pompey the Great, who had a triumph decreed him when he was only a Roman knight, and had not yet reached the ſenatorial age. The triumph was the moſt pompous ſhew among the ancients: authors uſually attribute its invention to Bacchus, and tell us that he firſt triumphed upon the conqueſt of the Indies, and yet this ceremony was only in uſe among the Romans. The Grecians had a cuſtom which reſembled the Roman triumph; for the conquerors uſed to make a proceſſion through the middle of their city, crowned with garlands, repeating hymns and ſongs, and brandiſhing their ſpears: the captives were alſo led by them, and all the ſpoils expoſed to public view. The order of a Roman triumph was briefly thus: The ſenate having decreed the general a triumph, and apppointed a day, they went out of the city-gate to meet the conqueror, and marched in order with him through the city. The cavalcade was led up by the muſicians, who had crowns on their heads; after them came ſeveral chariots, with plans and maps of the cities and countries ſubdued, done in relievo: they were followed by the ſpoils taken from the enemy, their horſes, arms, gold, ſilver, machines, tents, &c. After theſe came the kings, princes, or generals ſubdued, loaden with chains, and followed by mimics or buffoons, who inſulted over their misfortunes. Next came the officers of the conquering troops with crowns on their heads. Then appeared the triumphal chariot, in which was the conqueror richly clad, in a purple robe embroidered with figures of gold, ſetting forth his glorious atchievements: his buſkins were beſet with pearl, and he wore a crown, which at firſt was only laurel, but afterwards gold. One hand held a laurel branch, the other a truncheon. At his feet were his children, or ſometimes on the chariot horſes. It is added, that the public executioner was behind him, to remind him from time to time that theſe honours were tranſitory, and could not ſkreen him from the ſeverity of the laws, if he ſhould ever be found delinquent. As the triumphal chariot paſſed along, they ſtrewed flowers before it. The muſic played in the praiſe of the conqueror,

amidſt the loud acclamations of the people crying Io Triumphe. The chariot was followed by the ſenate clad in white robes, and the ſenate by ſuch citizens as had been ſet at liberty or ranſomed. The proceſſion was cloſed by the ſacrificers, and their officers and utenſils, with a white ox led along for the chief victim. In this order they proceeded through triumphal arches to the Capitol, where the victims were ſlain. In the mean time all the temples were open; the altars loaden with offerings and incenſe; games and combats were celebrated in the public places, and rejoicings appeared every where. What was horrible amidſt all this mirth, was, that the captives, when arrived at the Forum, were led back to priſon and ſtrangled: it being a point of religion with them not to touch the victims till they had taken full revenge of their enemies. The rites and ſacrifices over, the triumpher treated the people in the Capitol, under the porticoes, and ſometimes in the temple of Hercules.

An ingenious author obſerves, that it was the greateſt diminution of the Roman glory imaginable, that, in their inſtitution of public triumphs, they led their enemies in chains, when they were priſoners. It is to be allowed, that doing all honour to heroes, above the reſt of mankind, muſt needs conduce to the glory and advantage of a nation; but what ſhocks the imagination to reflect upon, is, that a polite people ſhould think it reaſonable, that an unhappy man, who was no way inferior to the victor, but by the chance of war, ſhould be led like a ſlave at the wheel of his chariot. This behaviour to the conquered had no foundation in nature or policy, only to gratify the inſolence of an haughty people, who triumphed over barbarous nations, by acting what was fit only for thoſe very barbarians to practiſe. It ſeems wonderful, that they who were ſo refined as to take care that, to complete the honour done to the victorious officer, no power ſhould be known above him in the empire, on the day of his triumph; but that the conſuls themſelves ſhould be but gueſts at his table that evening; could not admit the man of chief note among his priſoners to be one of the company. This would have improved the gladneſs of the occaſion, and the victor had made a much greater figure, in that no man appeared unhappy on this day, than becauſe no other man appeared greater. *Potter's Græc. Antiq. Kennet's Rom. Ant. Dict. Trevoux.*

TRIUMVIR, one of three perſons who govern abſolutely, and with equal authority, in a ſtate. It is chiefly applied to the Roman government: Cæſar, Pompey, and Craſſus, were the firſt triumvirs who divided the government amongſt them. There were alſo other officers, called triumvirs; as the triumviri or treſviri capitales, who were the keepers of the public gaol; they had the office of puniſhing malefactors; for which purpoſe they kept eight lictors under them. There were alſo triumviri monetales, the maſters of the mint; whence the following mark is ſtill extant on many antient coins, III VIRI. Sometimes they were ſtyled triumviri A. A. Æ. F. F. theſe letters ſtanding for *auro, argento, ære, flando, feriendo.* There were likewiſe nocturnal triumviri, inſtituted to prevent or extinguiſh fires in the night.

TRIUMVIRATE, an abſolute government adminiſtered by three perſons, with equal authority.

There were two famous triumvirates at Rome; Pompey, Cæſar, and Craſſus, as mentioned in the preceding article, eſtabliſhed the firſt; and Auguſtus, Marc Antony, and Lepidus, the ſecond; which gave the laſt blow to the Roman republic; for Auguſtus having vanquiſhed Lepidus and Antony, the triumvirate ſunk into a monarchy.

TROCHAIC VERSE, in the Latin poetry, a kind of verſe, ſo called becauſe the trochees chiefly prevail, as the iambus does in the iambic. It generally conſiſts of ſeven feet and a ſyllable; the odd feet, for the moſt part, conſiſt of trochees, though a tribrachys is ſometimes admitted, except in the ſeventh foot: theſe two feet are likewiſe uſed in the other places, as is alſo the ſpondæus, dactylus, and anapæſtus.

TROCHANTER, in anatomy, a name given to two apophyſes, ſituated in the upper part of the thigh-bone: they receive the tendons of moſt of the muſcles of the thigh.

TROCHE, *Trochiſcus*, in pharmacy, a ſort of medicine, made of glutinous ſubſtances, into little cakes, and afterwards exſiccated. The four following rules are to be obſerved in making of them: 1. The ingredients are to be reduced to a powder. 2. If the maſs proves ſo glutinous as to ſtick to the fingers in making up, the hands may be anointed with any convenient ſweet or aromatic oil; or elſe ſprinkled with powder of ſtarch, or with that of liquorice. 3. In order to dry thoroughly the troches, put them on an inverted ſieve, in a ſhady airy place, and frequently turn them. 4. The troches are to be kept in glaſs veſſels, or in earthen ones well glazed. There are troches of various kinds, and for various intentions, as purgative, alterative, aperitive, corroborative, &c. The chief troches now in uſe are thoſe of myrrh and liquorice, and thoſe of the teſtaceous powders for the heart-burn.

TROCHEE, *Trochæus*, in the Greek and Latin poetry, a foot conſiſting of two ſyllables, the firſt long, and the ſecond ſhort, as in the words *mūſa* and *sĕrvăt*.

TROCHILUS, in architecture, a name uſed by the antients for what the moderns call ſcotia.

TROCHITÆ, in natural hiſtory, a name given to the ſeparate joints of the entrochus. See the article ENTROCHUS.

TROCHLEA, one of the mechanical powers, uſually called a pulley. See PULLEY.

TROCHLEARES, in anatomy, a name given to the oblique muſcles of the eye.

TROCHOID, in geometry, a curve more generally known by the name of cycloid.

TROCHUS, in natural hiſtory, the name given by authors to a genus of ſhells; ſome of the ſpecies of which reſemble the figure of the trochus, or top which boys play with. As there are many ſpecies of this ſhell, however, which are flatted, and have nothing of this form, the whole ſeries are much better named, by a denomination taken from the ſhape of the mouth, which is of an oval figure, and is alike in all theſe ſpecies, and different from all other ſhells. They are therefore aptly characterized by a late French writer under the name of cochleæ ore depreſſo.

TROGLODYTES, in the ancient geography, a people of Ethiopia, ſaid to have lived in caves under ground. Pom. Mela gives a ſtrange account of the Troglodytes: he ſays, they did not ſo properly ſpeak as ſhriek, and that they lived on ſerpents.

TROJA, or TROJAN GAMES, were games ſaid to be inſtituted by Aſcanius, ſon of Æneas, and afterwards kept up by the Romans with great ſolemnity. They were celebrated by companies of boys, neatly dreſſed, and furniſhed with little arms and weapons, who muſtered in the public Circus. They were choſen, for the moſt part, out of the nobleſt families of Rome, and the captain of them had the honourable title of Princeps Juventutis, being ſometimes next heir to the empire, and ſeldom leſs than the ſon of a principal ſenator. A particular account of theſe games may be ſeen in the fifth Æneid of Virgil, beginning at verſe 545.

TROIS-CINQUE, in French diſtillery, a term uſed to expreſs their brandy when of a peculiar ſtrength, conſiſting of five parts alcohol, and three parts phlegm.

The method of diſtilling the wines into brandy, in France, is exactly the ſame with that uſed with us to draw the ſpirit from our waſh or fomented liquor of malt, treacle, ſugar, or whatever other kind. They only obſerve more particularly to throw a little of the natural lee into the ſtill, along with the wine; and the pooreſt wines are found to ſucceed beſt on the trial, making by much the fineſt brandies. We are apt to wonder, that we cannot from the wines of particular countries diſtil their particular brandies; but the whole myſtery conſiſts in this, that they do not ſend us over the ſame wines which they uſe in diſtilling, becauſe theſe latter would not be liked as wines, nor would keep in the bringing over.

Sometimes, in Scotland, they meet with the poor and pricked wines, the ſame that the French diſtil their brandies

dies from; and from theſe they diſtil a ſpirit, not to be known from the brandy diſtilled in France.

The lee, which the French add in the diſtillation, gives the brandy that high flavour for which we ſo much eſteem it; but they themſelves like it much the worſe for it. The French notion of a proof ſtrength, determined by the chaplet or crown of bubbles, is the ſame with ours; and all their fine ſpirits are found of this ſtrength.

But they have one particular expedient for thoſe brandies which prove foul and ſeedy, or retain the taſte of certain weeds which grow among the wines; they draw them over again, with a deſign to free them from that adventitious flavour. In this operation they always leave out the faints, or rather they change the receiver as ſoon as ever the ſtream comes proof; then mixing together all that run off before, they make a brandy ſtronger than the ordinary kind, and this is what they call trois-cinque.

The diſtillers in France ſcarce ever bring their brandies higher than this; for they have the art to perſuade the foreign merchant, that the phlegm of French brandy is natural and eſſential to it: but the truth is, that the ſpirit alone contains the flavour and excellence of the brandy, and it might as well be reduced to half its bulk for exportation, and ſent over in the ſtate of alcohol, and then lowered with common water, to the proof ſtrength.

The French uſe no art in colouring their trois-cinque, any more than their common proof-brandy, nor do they add any thing to give them an additional flavour; the thing which they principally value themſelves upon, both in regard to brandies and wines, being to make them perfectly natural: ſo that all the colour we find in their brandies, is acquired from the caſk, and the time they are left in it. This is often twelve or eighteen months, ſometimes two or three years; in this time they acquire a brown colour, and loſe their acrid taſte.

The greateſt adulteration of brandies is in England; the French have no temptation to do it, they having no cheaper ſpirit, ſince the prohibition of moloſſes in their country. The Dutch are in the ſame condition, having no moloſſes ſpirit; and only a very coarſe and nauſeous ſugar-ſpirit, and yet a worſe malt-ſpirit of their own manufacture; a ſingle gallon of which would ſpoil a whole piece of brandy. The French brandy alſo, paying no duty in Holland, is as cheap, or nearly ſo, there, as in France itſelf. The duties being high upon brandy, it is greatly adulterated, and that with all ſorts of ſpirits, &c. as malt, moloſſes, cyder, and ſugar-ſpirits: and, when this is done in a dexterous and ſparing manner, the cheat is not eaſily found out. *Shaw's Eſſay on Diſtillery.*

TROLLIUS, globe ranunculus, in botany, a genus of plants, the flower of which has no empalement; it has about fourteen oval petals, whoſe points meet together, with nine nectariums, which are narrow, plain, incurved, and umbilicated, perforated at their baſe, and a great number of briſtly ſtamina, terminated by erect ſummits, with numerous germina ſitting cloſe like a column, having no ſtyles, but are crowned by pointed ſtigmas. The germen afterward becomes ſo many capſules, collected into an oval head, each containing one ſeed.

There are two ſpecies of this plant enumerated by Mr. Miller. The firſt ſort grows naturally in the northern counties in England, and in many parts of Wales. It has been found in great plenty growing in the park of Burrow-Hall, in Lancaſhire; it has a perennial, fibrous, black root, from which ſpring up many leaves, which reſemble thoſe of wolfs-bane, cut into five ſegments almoſt to the bottom; the ſtalk riſes near two feet high; it is ſmooth, hollow, and branches toward the top; each branch is terminated by one large yellow flower, ſhaped like thoſe of crow-foot, which has no empalement, compoſed of ſeveral concave petals, whoſe points turn inward toward each other, covering the parts of generation, ſo are of a globular form; whence it had the name of globe ranunculus. It flowers the latter end of May and the beginning of June, and the ſeeds ripen in Auguſt. This plant is frequently kept in gardens about London, and is eaſily propagated by parting of the roots; the beſt time for doing this is the latter end of September, when the leaves are beginning to decay. The roots ſhould not be divided into ſmall parts, if they are expected to flower ſtrong the following year, and ſhould be planted at a foot diſtance from each other; it requires a ſhady ſituation and a moiſt ſoil. The roots need not be removed or parted oftener than once in three years, unleſs there is a deſire of increaſing them.

The ſecond ſort grows naturally in Siberia, from whence it was brought to the imperial garden at Peterſburgh, and has been communicated ſince to ſeveral parts of Europe; this differs from the firſt in having larger leaves, which are of a lighter green colour; their ſegments are fewer and larger, reſembling thoſe of the yellow monkſhood. The petals of the flower ſpread open, and do not converge at their points like thoſe of the firſt ſort. The flowers, ſtamina, and nectariums, are of an elegant ſaffron colour. It flowers in May.

This ſort may be propagated and treated in the ſame way as the firſt; but it requires a moiſter ſoil, and ſhould have a ſhady ſituation, but not under the drip of trees; it thrives beſt on a north border where the ſoil is loamy, but not too ſtiff. In ſuch ſituations the plants will produce ſeeds in England; but if they are in a dry ſoil, or much expoſed to the ſun, they frequently die in ſummer. Mr. Miller ſays he has ſeen this ſort in the moſt flouriſhing ſtate, where the ſurface of the ground was covered with moſs to keep it moiſt.

As the flowers of both theſe plants make a pretty appearance during their continuance, they deſerve a place in every good garden for the ſake of variety, eſpecially as they will thrive in moiſt ſhady places where few better plants will live; and by thus ſuiting the plants to the different ſoils and ſituations of a garden, every part may be furniſhed with beauties, and a great variety may be preſerved.

TRONAGE, an antient cuſtomary toll, paid for weighing of wool. This word is particularly mentioned in a charter granted to the mayor and citizens of London; in which city there is an officer called tronator, whoſe buſineſs it is to weigh the wool that is brought thither.

TRONCONNEE, in heraldry, denotes a croſs, or other thing, cut in pieces and diſmembered, yet ſo as all the pieces keep up the form of a croſs, though ſet at a ſmall diſtance from one another.

TRONE-WEIGHT, the ſame with what we now call troy-weight.

TROOP, a ſmall body of horſe or dragoons, about fifty or ſixty, ſometimes more, ſometimes leſs; commanded by a captain. Each troop, beſides a captain, has a lieutenant, cornet, quarter-maſter, and three corporals, who are the loweſt officers of a troop.

TROPÆOLUM, the Indian Creſs, in botany, a genus of plants, the flower of which conſiſts of five roundiſh petals inſerted into the diviſions of the cup; the two upper petals are ſeſſile; the three others have very long and barbated ungues; the fruit conſiſts of three convex capſules, ſulcated and ſtriated on one ſide, and angular on the other; the ſeeds are three, gibbous on one ſide, and angulated on the other, but upon the whole ſomewhat roundiſh, and ſtriated deeply.

There are two ſorts of this plant, the firſt growing naturally in Peru, and the ſecond about Lima. The firſt ſort is leſs common at preſent in the Engliſh gardens than the ſecond, though it was formerly more ſo; the flowers of the latter being larger make a finer appearance, for which it is preferred; they are both eſteemed annual plants, though they may be continued through the winter, if they are kept in pots, and ſheltered in a good green-houſe; the former produce no ſeeds, and are therefore propagated by cuttings; but the latter ripen their ſeeds conſtantly every year, and the plants are generally raiſed from them. Theſe may be ſown in April in the places where they are to remain, which ſhould be where their ſtalks may have ſupport; for they will climb ſix or eight feet high, when they are trained up, and then

their flowers will make a good appearance; but when they trail upon the ground, they will ſpread over the neighbouring plants, and become unſightly.

The flowers of theſe plants are frequently eaten in ſallads; they have a warm taſte like the garden creſs, and are eſteemed very wholeſome; they are likewiſe uſed for garniſhing diſhes. The ſeeds are pickled, and by ſome are preferred to moſt kinds of pickles for ſauce.

TROPE, in rhetoric, a kind of figure of ſpeech, whereby a word is removed from its firſt and natural ſignification, and applied with advantage to another thing, which it does not originally mean; but only ſtands for it, as it has a relation to, or connection with it: as in this ſentence, "God is my rock." Here the trope lies in the word *rock*, which being firm and immoveable, excites in our minds the notion of God's unfailing power, and the ſteady ſupport which good men receive from their dependence upon him.

Tropes are uſed for the ſake of an agreeable variety; they divert the mind, and revive attention, when it begins to flag and be weary. In many caſes there is an abſolute neceſſity for the writer or ſpeaker to repeat the ſame thing ſeveral times; therefore, to prevent the tireſome repetition of the ſame words, he carefully diverſifies his expreſſions, and judiciouſly intermixes plain and figurative language. Tropes add a wonderful ornament and ſtrength to a diſcourſe, and often give the mind a brighter and ſtronger idea of a thing, than proper words: Thus Virgil calling the two Scipios the "Thunder-bolts of war," repreſents the rapid ſpeed and victorious progreſs of their arms more emphatically, than all the plain terms of the Roman language could have done. In order to make uſe of tropes ſeaſonably, and with advantage, the following rules ſhould be obſerved: 1. Be ſparing and cautious in the uſe of them, and omit them when they are not either as plain as proper words, or more expreſſive: tropes are the riches of a language, and it will be an imputation upon a man to laviſh them away without diſcretion. 2. Care muſt be taken, that tropes hold a proportion to the ideas intended to be raiſed by them; there ought to be an eaſy and unforced relation betwixt the trope and the proper word it is put for, or the thing intended to be expreſſed by it: when there is not this ſuitableneſs and relation, the expreſſion at beſt will not only be harſh and unpleaſant, but often ridiculous and barbarous. In order to preſerve this relation, a trope ought not to expreſs more or leſs than the thing requires; and things capable of heightening or ornament ought not to be debaſed nor vilified by low expreſſions; nor ſmall matters over-magnified by pompous and ſwelling words. 3. A trope ought to be obvious and intelligible, and therefore muſt not be fetched from things too remote, ſo as to require much reading and learning to apprehend it.

TROPHY, *Trophæum*, among the ancients, a pile or heap of arms of a vanquiſhed enemy, raiſed by the conqueror in the moſt eminent part of the field of battle.

The trophies were uſually dedicated to ſome of the gods, eſpecially Jupiter. The name of the deity to whom they were inſcribed, was generally mentioned, as was that alſo of the conqueror. The ſpoils were at firſt hung upon the trunk of a tree; but inſtead of trees, ſucceeding ages erected pillars of ſtone, or braſs, to continue the memory of their victories. To demoliſh a trophy was looked upon as a kind of ſacrilege, becauſe they were all conſecrated to ſome deity.

The repreſentation of a trophy is often to be met with on medals of the Roman emperors, ſtruck on occaſion of victories; wherein, beſides arms and ſpoils, are frequently ſeen one or two captives by the ſides of the trophy.

In architecture trophy ſignifies an ornament which repreſents the trunk of a tree, charged or encompaſſed all round about with arms or military weapons, both offenſive and defenſive.

TROPHY MONEY, denotes certain money annually raiſed in the ſeveral counties of the kingdom, towards providing harneſs, and maintaining the militia.

TROPICS, in aſtronomy and geography, are two circles ſuppoſed to be drawn on each ſide of the equinoctial, and parallel thereto. That on the north-ſide of the line is called the tropic of cancer, and the ſouthern tropic has the name of capricorn, as paſſing through the beginning of thoſe ſigns. They are diſtant from the equinoctial 23° 29′. Two circles drawn at the ſame diſtance from the equator on the terreſtrial globe, have the ſame names in geography, and they include that ſpace or part of the ſphere, which is called the torrid zone, becauſe the ſun is, at one time or other, perpendicular over every part of that zone, and extremely torrifies or heats it. See ZONE.

TROT, in the manege, one of the natural paces of a horſe performed with two legs in the air, and two on the ground at the ſame time croſs-wiſe, like St. Andrew's croſs, and continuing ſo alternately to raiſe the hind-leg of the one ſide, and the fore-leg of the other ſide at once, leaving the other hind and fore-leg upon the ground, till the former come down. In this motion, the nearer the horſe takes his limbs from the ground, the opener, the evener, and ſhorter his trot will be. If he takes up his feet ſlovenly, it is a ſign of ſtumbling and lameneſs; if he treads narrow or croſs, it betokens interfering or failing; if he treads long it ſhews over reaching; if he ſteps uneven, it beſpeaks toil and wearineſs.

TROVER, in law, an action which a man hath againſt one that, having found any of his goods, refuſeth to deliver them upon demand,

TROUGH *of the Sea*, is the hollow or cavity made between two waves or billows in a rolling ſea.

TROUSSEQUIN, in the manege, an arch of wood raiſed above the hinder bow of a great ſaddle, in order to keep the bolſters firm.

TROUT, a very valuable river-fiſh, the diſtinguiſhing characters of which are theſe: its body is long; its head ſhort and roundiſh; the end of its noſe or ſnout obtuſe and blunt; its tail is very broad; its mouth large; and each jaw furniſhed with one row of ſharp teeth; and in its palate there are three parcels of teeth, each of an oblong figure in the congeries, and all meeting in an angle near the end of the noſe; and the tongue has ſix, eight, or ten teeth alſo on it, and its ſides are beautifully variegated with red ſpots.

This delicious fiſh is obſerved to come in and go out of ſeaſon with the ſtag, and buck; the time of its ſpawning is remarkable; moſt other fiſh do this in warm weather, but the Trout in October or November. Among the ſeveral kinds of Trout, the red and the yellow are the beſt for the table; and, in the ſame ſpecies, the female has always the preference to the male; the head of the female is ſmaller, and the body deeper than in the male. They are known to be in ſeaſon by the bright colour of their ſpots, and by the largeneſs and thickneſs of their backs; which laſt is a general rule in regard to all fiſh, to know when they are in ſeaſon.

In winter the trout is ſick, lean and unwholeſome, and very often is louſy. The louſe, as it is called, of the trout, is a ſmall worm with a large head, which ſticks very faſt to the ſides of the fiſh; they live upon the juices of the fiſh all the time of the cold weather, while he is poor and lies quiet in the deep waters; but when the warm weather in the ſpring comes on, and the fiſh leaves his lazy life at the bottom, and comes up to the ſhallow gravelly places, where the ſtream is ſwift, he ſoon ſhakes them off.

The trout, at his firſt coming into the ſhallow waters, may be ſeen to rub his body continually upon the ſharp gravel at the bottom; it is by this means he gets off theſe worms or lice, as they are called. From this time he begins to feed on flies; but, in May, the peculiar fly that he is fond of is produced, and, after feeding that whole month on this inſect, the fleſh of the fiſh becomes more red and firm, and its higheſt ſeaſon begins.

The general baits for a trout, are a worm, a minnow, or a fly, whether natural or artificial: among worms, there are ſeveral kinds which this fiſh is fond of; ſuch are the earth-worm and dung worm in particular; the lob-worm and branding-worm are alſo eſteemed: but the beſt of all is the ſquirrel-tail-worm, which has a ſtreak down the back, a red head, and a broad tail.

The

The brandling is commonly found in an old dung-hill, or under cow-dung, or elſe among tanners bark; the others are found in the earth, and under large ſtones or ſtumps of trees: whatever worm is uſed, the longer it is kept to ſcower firſt, the better the trout will take it: they are to be kept in an earthen pot among moſs, which is to be ſhifted once in three or four days, or oftener, if the weather be very hot.

To take the trout with a ground-bait, the angler ſhould have a light taper rod, with a tender hazel top; and may angle with a ſingle hair of three links, the one tied to the other, for the bottom of the line; and a line of three-haired links for the upper part: with this ſort of tackle, if the ſportſman have room enough, he will take the largeſt trout in the river. Some fiſh with three-haired links at the bottom of the line, but there is very little ſport to be expected this way, for the trout is very ſuſpicious, and very quick-ſighted. The angler muſt always keep out of ſight, and the point of the rod muſt be down the ſtream. The ſeaſon for fiſhing for the trout with a ground-bait begins in March, and the mornings and evenings in general are the beſt times; but, if the weather be cloudy, the ſport may be followed all day long: there muſt be a plummet at ten inches from the hook, which the angler muſt feel always touching the ground, and this muſt be heavier, the ſwifter the ſtream is. The common worm is a good bait.

The minnow is a very good bait for the trout, and with this the tackle need not be ſo ſlight, for the trout will make at this bait with leſs conſideration, and ſeize it as ſoon as it comes in ſight; the upper part of the line with this bait may be of three ſilks and three hairs for the upper part, and two ſilks and two hairs for the lower; and the hook may be moderately large. The whiteſt minnows and thoſe of the middle ſize are the beſt bait for the trout, and they ſhould be ſo fixed on the hook, as to turn round when they are drawn up againſt the ſtream.

The beſt way of baiting this fiſh is to put the hook in at the mouth and out at the gills, then drawing it through about three inches, to put it again into its mouth, and let the point and beard come out at the tail, and then to tie the hook and his tail with a fine white thread, letting the body of the minnow be almoſt ſtraight down to the hook; by this means it will turn, as it is pulled againſt the ſtream: and, the more and quicker it turns, the better: for want of a minnow, a ſmall loach or a ſtickleback will ſerve.

The moſt agreeable manner of fiſhing for trout is, however, with the fly, when the ſportſman has found the true method of doing it; the rod in this caſe muſt be light and pliable, and the line long and fine; if one hair be ſtrong enough, as it may be made, by proper ſkill in the angler, there will be more fiſh caught, than where a thicker line is uſed; and the fly-fiſher ſhould have the wind at his back, and the ſun before him.

TRUCE, in the art of war, denotes a ſuſpenſion of arms, or a ceſſation of hoſtilities between two armies, in order to ſettle articles of peace, bury the dead, or the like.

TRUCHMAN, DRAGOMAN, or DROGMAN, in the countries of the Levant, ſignifies an interpreter.

TRUCKS, among gunners, round pieces of wood, in form of wheels, fixed on the axle-trees of carriages, to move the ordnance at ſea, and ſometimes alſo at land.

TRUE, ſomething agreeable to the reality of things, or to truth.

TRUE *place of a planet, or ſtar*, in aſtronomy, is a point of the heavens, ſhewn or pointed out by a right line, drawn from the center of the earth through the center of the planet or ſtar.

TRUFFLES, *Tubera terræ*, in natural hiſtory, a kind of ſubterraneous vegetable production, not unlike muſhrooms.

All ſubſtances which appear to vegetate may, generally ſpeaking, be divided into two claſſes; ſuch as have all the characteriſtics of plants, and ſuch as want ſome of theſe characteriſtics. Among thoſe of the latter kind, ſome have no appearance of flowers, as the fig-tree, whoſe flower is thought to be wrapped up in its fruit; others want the appearance both of flowers and ſeeds, ſuch as the moſt part of the ſea-plants, whoſe ſeeds are ſuſpected to be concealed in particular veſicles deſtined for that purpoſe; others have only leaves without ſtalks, ſuch as liverwort, ſea-lettice, and noſtoch; others have ſtalks without leaves, ſuch as the euphorbium, the horſe-tail, the ſea-oak, corals, and the moſt part of ſtony plants. Laſtly, others have ſcarcely any appearance of plants, not having viſibly either leaves, flowers, or ſeeds. Of this kind are moſt muſhrooms, ſponges, morellæs, and eſpecially truffles, which are likewiſe without roots. Botaniſts have only ranked them among the claſs of plants, becauſe they are obſerved to grow and multiply, not doubting, but they contained the eſſential, though they were deſtitute of the apparent parts of plants; as inſects have the eſſential parts of an animal, though their outward form ſhould have a different appearance. Having made ſome obſervations on the noſtoch, I was led to examine the truffle alſo, which is ſtill more ſingular, and, for aught I know, has as yet had nothing poſitive advanced concerning it; I ſhall therefore give an account of the obſervations I have made upon it, and the uncommon manner of its vegetation.

This ſort of plant is only a fleſhy tubercle covered with a hard ſort of cruſt, rough, and ſomewhat regularly furrowed, on the ſurface almoſt like the cypreſs-nut. It does not riſe above the ſurface of the earth, but lies concealed about half a foot below it. Great numbers of them are found in the ſame place, of different ſizes. Some of them are now and then found of a pound weight, or even a pound and a quarter; theſe laſt are but rare, and Pliny only mentions their being of a pound weight.

It is certain, however, that ſome of them are very large; they grow in different countries, and, in Pliny's time, the moſt valuable were brought from Africa. They are now found in Europe, in Brandenburgh, and ſeveral other parts of Germany, and are very common in Italy, Provence, Dauphiné, Languedoc, Anjou, and Perigord. They grow alſo in Burgundy, and ſome of them are found about Paris; it is obſerved, that they are ordinarily found in fields, that they are uncultivated, of a reddiſh-coloured earth, and ſandy, but ſomewhat rich. They grow at the feet, and under the ſhades of trees, ſometimes about the roots of ſtones, and ſometimes in clear earth. Their favourite trees are either the white or green oak, as the elm is that of the morellæ. They begin to be found when warm weather firſt ſucceeds the cold, ſooner or later, as the ſeaſon is more or leſs mild; for they have ſometimes been very rare after hard winters. At firſt they appear only like little round peaſe, red without, and white within. Theſe peaſe grow larger by degrees; from that time they take out of the ground what they commonly call white truffles; theſe are of themſelves inſipid, and people dry them as an ingredient for ragouts, becauſe they keep better, when dried, than marbled ones do. It is a common opinion, that truffles which have once been removed from their places, are never after capable of being nouriſhed, even when put in ſome earth from which they were originally taken: but if one leave them there for a certain ſeaſon, without diſturbing them, they grow inſenſibly larger, their bark becomes black, rough, and unequal, though they always retain their whiteneſs within. Hitherto, they have very little ſmell or taſte, and can only be uſed in ragouts. Theſe are always called the firſt white truffles; and are not to be made a different ſpecies from the marbled or black ones gathered in the end of autumn, and even in the winter after the froſts are begun; for, in my opinion, they are only the ſame, arrived at different degrees of maturity. I look upon the white truffles, in its firſt ſtate, as a plant which is at one and the ſame time, root, ſtalk, and flower, whoſe parenchyma ſwells every way, and whoſe parts are inſenſibly unfolded: in proportion as the truffle ſwells, its bark becomes hard and furrowed in different places, that ſo it may convey the more nouriſhment to the groſſer maſs: then the truffle changes its colour, and, inſtead of white, it inſenſibly becomes marbled with greyiſh ſtreaks, and that which was formerly white, now looks like a congeries of ſmall pipes, which ſpread themſelves in the heart of the truffle, and terminate in the furrows of the bark.

The greyiſh ſubſtance which is wrapped up amidſt theſe canals, when viewed with a microſcope, appears to be a tranſparent parenchyma, compoſed of veſſels, or little bladders: in the middle of this ſubſtance appear black round points diſtinct from one another, which have all the appearance of ſeeds nouriſhed in that ſubſtance, whoſe colour they have darkened, and in which there remains nothing white except the veſſels and ſome capſulæ. I look upon that white ſubſtance as hollow pipes, becauſe I always ſee them terminate in the bark.

When the truffles are arrived at this degree of maturity, they are of a very good ſmell and taſte: the heat and rain, during the month of Auguſt, forward their ripening very faſt, which may poſſibly be the reaſon why ſome authors have ſaid that ſtorms and thunder firſt produced them. The truth is, good truffles are not dug but from the month of October to the end of December; and ſometimes to the end of February and March, when they are ever at that time marbled; whereas thoſe gathered from the month of April till July and Auguſt, are only white. If the people neglect to gather the truffles when arrived at a due degree of maturity, they rot; and then we may obſerve the re-production of the truffle, becauſe, after ſome time, we ſee ſeveral bunches of other young truffles filling up the places of the rotten ones. Theſe young truffles are nouriſhed till the firſt colds come on, and if the froſts are not intenſe, they get over the winter, and furniſh us betimes with the freſh green truffles.

The exceſſive cold in the year 1709 is an additional proof of what I advance, ſince truffles were not found till the autumn of that year; the moſt forward ones, which ſhould have appeared in the ſpring, having periſhed by the rigour of the ſeaſon, whereas they were very common the foregoing year.

We obſerve neither hairs nor filaments of roots at the truffles, when taken out of the earth, with which they are covered in ſuch a manner as to leave the traces of their bark imprinted in it, without appearing to have any other communication with it. They are ſubject, like other roots, to be eat into by worms. The worm which preys upon the truffle is white, ſmall, and different from that which is hatched by its corruption: afterwards, this worm forms a kind of bean, ſhut up in a very ſlender covering of a white kind of ſilk; from which, ſome time after, comes forth a bluiſh violet coloured fly, which makes its way, from the truffle, thro' the furrows or clefts obſerved in it. Theſe flies are infallible ſigns that there are truffles to be found near the places where they are obſerved.

If a dreſſed truffle has been pierced by a worm, it may be diſcovered by its being bitter to the taſte; and, by a little attention, one may obſerve the place where the hole is, to be blacker than the reſt, and that the bitterneſs is cauſed by it, ſince the reſt of the truffle taſtes well. Upon laying open the place where the hole is, one may eaſily diſcover the neſt of the worm, and a place round it free from marbling, of a different colour from the reſt of the truffle, and reſembling that of rotten wood. Upon viewing the ſurface of truffles with a microſcope, I found that certain white ſpecks, which I ſaw there, were ſo many ſmall inſects which preyed upon them. They follow the furrows of the bark, that they may the more commodiouſly ſuck their nouriſhment. Theſe inſects are white, tranſparent, and of a round figure, almoſt like mites. They have only four feet, a ſmall head, and creep pretty faſt. Theſe inſects are nouriſhed by the nutritive juice of the truffle; for I have found ſome of them lodged in the ſame cell which had formerly been inhabited by the worm: they were become, though tranſparent, of a coffee-colour, like the place where the worm had neſtled. It is to be obſerved, that the earth which produces truffles, bears no other plants upon it; for the truffle abſorbs its nutritive juice, or rather, by its ſmell, deſtroys, or prevents, the ſpringing of other herbs. This reaſon appears to me ſo much the more probable, becauſe the earth wherein they grow ſmells perfectly like them. The peaſants, in ſome parts, receive profits ſo conſiderable from the ſale of truffles, as to render them very induſtrious in diſcovering the grounds where they grow, ſo that they are become now very ſkilful at it. They know the extent of the ground where the truffles are by its bearing nothing, and being void of all herbs. In the ſecond place, according to the quality of the earth, if the ground abounds with truffles, it is chapped in ſeveral places. They alſo know it by its being more light than other earth, by theſe little, bluiſh, violet-coloured flies I have mentioned, and by another ſort of flies which are large, black, long, and different from thoſe produced from the worm, but which are ingendered by the corruption of the truffle, and like thoſe which are hatched in every other corrupted matter. There is a dexterity in digging truffles, without cutting them, if they are large. The peaſants have a kind of planting-ſtick for digging them. In other parts, they do not trouble themſelves with ſearching for them, but have recourſe to another method mentioned by Pliny, and other authors. Swine are known to be very greedy of truffles; they, themſelves, make uſe of one of theſe animals, which they train up to diſcover and dig them; but there is a neceſſity for being very quick in taking the truffles from them, and giving them ſomething in their ſtead, leſt they ſhould be diſcouraged, and give over a purſuit from which they receive no advantage; and in Montferrat they have dogs trained up for this very purpoſe.

As to the virtues of truffles, the common opinion is, that they are hot. Galen, however, according to Matthiolus, looks upon them as indifferent, and the baſis of all other ſeaſoning; and indeed it is to this purpoſe that they are uſed in all ragouts. Avicenna ſpeaks of them in a manner quite different, and ſays, they engender thick humours more than any other food; that they are hard of digeſtion, heavy on the ſtomach, and, when much uſed, have a tendency to bring on an apoplexy and palſy. Theſe two authors may be reconciled, if we conſider two qualities in the truffle, which are capable of producing two different effects: firſt, they may prove hot of themſelves, by emitting their volatile ſalts into the ſtomach; or by being mixed with ſalt, pepper, and other ſpices, which they drink up like a ſponge. In the ſecond place, they may prove of hard digeſtion, when eaten immoderately by a perſon of a weak ſtomach: in which caſe they produce bad effects, ſtagnate, and form themſelves into a glareous ſubſtance, which diſorders the ſtomach, and which may be occaſioned by the cold quality aſcribed to them by Galen. As a proof that the truffle is of hard digeſtion, it has this in common with other fruits, that it grows hard in ſpirit of wine, and is with difficulty diſſolved in water. *Geoffroy, in the Memoires de l'Acad. Roy. des Scienc.* A. 1711.

TRUMPET, a muſical inſtrument, the moſt noble of all portable ones of the wind kind, uſed chiefly in war among the cavalry, to direct them in the ſervice.

Marine TRUMPET, is a muſical inſtrument conſiſting of three tables, which form its triangular body. It has a very long neck, with one ſingle ſtring, very thick, mounted on a bridge, which is firm on one ſide, but tremulous on the other. It is ſtruck by a bow with one hand, and with the other the ſtring is preſſed, or ſtopped, on the neck by the thumb. It is the trembling of the bridge, when ſtruck, that makes it imitate the ſound of a trumpet; which it does to that perfection, that it is ſcarce poſſible to diſtinguiſh the one from the other: and this is what has given it the denomination of marine trumpet; though, in propriety, it is a kind of monochord.

Harmonical TRUMPET, an inſtrument that imitates the ſound of a trumpet; which it reſembles in every thing, excepting that it is longer, and conſiſts of more branches: it is generally called ſackbut.

Speaking TRUMPET, is a tube from ſix to fifteen feet long, made of tin, perfectly ſtraight, and with a very large aperture; the mouth-piece being big enough to receive both lips.

The ſpeaking trumpet, or ſtentorophonic tube, as ſome call it, is uſed for magnifying of ſound, particularly that of ſpeech, and thus cauſing it to be heard at a great diſtance. How it does this will be eaſy to underſtand from the ſtructure thereof, thus illuſtrated by the ingenious

ingenious Mr. Martin: let A B C (plate CXXXII. *fig.* 20.) be the tube, B D the axis, and B the mouth-piece for conveying the voice to the tube.

Then it is evident, when a perſon ſpeaks at B, in the trumpet, the whole force of his voice is ſpent upon the air contained in the tube, which will be agitated through the whole length of the tube; and by various reflections from the ſide of the tube to the axis, the air along the middle part of the tube will be greatly condenſed, and its momentum proportionably increaſed; ſo that, when it comes to agitate the air at the orifice of the tube A C, its force will be as much greater than what it would have been without the tube, as the ſurface of a ſphere, whoſe radius is equal to the length of the tube, is greater than the ſurface of the ſegment of ſuch a ſphere, whoſe baſe is the orifice of the tube. See the article SOUND.

For a perſon ſpeaking at B, without the tube, will have the force of his voice ſpent in exciting concentric ſuperficies of air all around the point B; and, when thoſe ſuperficies or pulſes of air are diffuſed as far as D, every way, it is plain the force of the voice will be diffuſed through the whole ſuperficies of a ſphere whoſe radius is B D; but in the trumpet it will be ſo confined, that, at its exit, it will be only diffuſed through ſo much of that ſpherical ſurface of air, as correſponds to the orifice of the tube. But, ſince the force is given, its intenſity will be always inverſely, as the number of particles it has to move; and therefore, in the tube, it will be to that without, as the ſuperficies of ſuch a ſphere to the area of the large end of the tube, nearly.

To make this matter yet plainer by calculation, let B D = 5 feet, then will the diameter of the ſphere D E = 10 feet, the ſquare of which is 100, which, multiplied by 0,7854, gives 78,54 ſquare feet for the area of a great circle A H E F C.

And, therefore, four times that area, viz. 4×78,54 = 314,16 = ſquare feet in the ſuperficies of the aerial ſphere. If now the diameter A C, of the end of a trumpet, be one foot, its area will be 0,7854; but 7854 : 314,16 :: 1 : 400, therefore the air at the diſtance of B D, will be agitated by means of the trumpet, with a force 400 times greater than by the bare voice alone.

Again, it is farther evident how inſtruments of this form aſſiſt the hearing greatly; for the weak and languid pulſes of the air being received by the large end of the tube, and greatly multiplied and condenſed by the tremulous motion of the parts of the tube, and air agitated by them, are conveyed to the ear by the ſmall end, and ſtrike it with an impetus as much greater than they would have done without it, as the area at the ſmall end at B, is leſs than the area of the large end A C. From what has been ſaid, it is evident the effect of the tube in magnifying ſound, either for ſpeaking or hearing, depends chiefly upon the length of the tube. But yet ſome advantage may be derived from the particular ſhape thereof. Some very eminent philoſophers have propoſed the figure which is made by the revolution of a parabola about its axis, as the beſt of any, where the mouth-piece of the parabola, and, conſequently, the ſonorous rays, will be reflected parallel to the axis of the tube.

But this parallel reflection ſeems no way eſſential to the magnifying of ſound; on the contrary, it appears rather to hinder ſuch an effect, by preventing the infinite number of reflections and reciprocations of ſound; in which, according to Sir Iſaac Newton, its augmentation doth principally conſiſt. For all reciprocal motion, in every return, is augmented by its generating cauſe, which is here the tremulous motions of the parts of the tube. Therefore in every repercuſſion from the ſides of the tube, the agitations and pulſes of confined air muſt neceſſarily be increaſed; and conſequently, this augmentation of the impetus of the pulſes muſt be proportional to the number of ſuch repercuſſions; and, therefore, to the length of the tube, and to ſuch a figure as is moſt productive of them. Whence it appears, that the parabolic trumpet is, of all others, the moſt unfit for this purpoſe, inſtead of being the beſt.

But there is one thing more which contributes to the augmenting of theſe agitations of air in the tube, and that is the proportion which the ſeveral portions of air bear to each other, when divided by tranſverſe ſections, at very ſmall, but equal diſtances, from one end of the tube to the other. Thus, let thoſe ſeveral diviſions be made at the points, *a*, *b*, *c*, *d*, *e*, &c. (*fig.* 21.) in which let the right lines *a k*, *b l*, *c m*, *d n*, &c. be taken in geometrical proportion. Then will the portions of air contained between B and *a*, *a* and *b*, *b* and *c*, *c* and *d*, &c. be very nearly in the ſame proportion, as being in the ſame ratio with their baſes, when the points of diviſion are indefinitely near together.

But when any quantity of motion is communicated to a ſeries of elaſtic bodies, it will receive the greateſt augmentation when thoſe bodies are in geometrical proportion. Therefore, ſince the force of the voice is impreſſed upon, and gradually propagated through, a ſeries of elaſtic portions of air in a geometrical ratio to each other, it ſhall receive the greateſt augmentation poſſible.

Now, ſince by conſtruction it is B *a* = *a b* = *b c* = *c d*, &c. and alſo *a k* : *b l* :: *b l* : *c m* :: *c m* : *d n*, and ſo on; therefore, the points *k*, *l*, *m*, *n*, *o*, *p*, *q*, *r*, *s*, A, will, in this caſe, form that curve line, which is called the logarithmetic curve; conſequently, a trumpet, formed by the revolution of this curve about its axis, will augment the ſound in a greater degree than any other figured tube whatever.

Liſtening, or *Hearing* TRUMPET, an inſtrument invented by Joſeph Landini, to aſſiſt the ear in hearing of perſons who ſpeak at a great diſtance, without the aſſiſtance of any ſpeaking trumpet.

TRUMPET-FLOWER, *Bignonia*, in botany. See the article BIGNONIA.

TRUMPET-SHELL, in natural hiſtory, the Engliſh name of the buccinum of authors. See the article BUCCINUM.

The family of the buccina, when examined ever ſo ſtrictly, is very large; but, according to the general cuſtom of authors, of confounding together ſeveral genera under the name, it is uſually made to appear much larger than it really is. Liſter has made it comprehend a vaſt number of ſhells, by confounding with it the families of the murex and purpura.

It is not indeed peculiar to this author to have confounded theſe genera; thoſe who went before him have done the ſame: and Pliny has compriſed the buccinum, murex, and purpura, under the general name ceryx.

To avoid the general confuſion which ariſes from not diſtinguiſhing the families of the buccinum, murex, purpura, and vis, or ſcrew-ſhell, it will be proper to obſerve, that there are regular characters which diſtinguiſh them all one from another; the characters are theſe:

The buccinum differs from the purpura, in that it has a very long mouth of an oval figure, and has an elevated head; whereas the purpura has a round mouth, and a head ſomewhat flatted. The tail of the purpura is alſo uſually furrowed, and is ſhorter than that of the buccinum.

The buccinum differs alſo from the murex in having a longer tail, by the ſmoothneſs and variety of colours of its coat, and by having a larger mouth leſs furniſhed with teeth; the murex having a ſmaller and longer ſhaped mouth, its ſurface covered with points or ſpires, and ſeveral teeth.

It is eaſier to diſtinguiſh the buccinum from the ſcrew-ſhell, as this is always more long and ſlender than the buccinum; it has alſo a flat mouth, and has rarely any tail. Theſe are all very large families in nature, and it is highly neceſſary for the naturaliſts to be well acquainted with them. The moſt ſingular ſpecies of the buccinum claſs is one that hath its mouth turned the contrary way to all other ſhells: this has been thence called by authors the unique and the ſans pareil. Aldrovand is of opinion, that the buccina may be ranked among the bivalve ſhells; becauſe they have an operculum or ſhelly ſubſtance fixed to the end of their body, which occaſionally ſtops up the aperture of the mouth; but if this were a ſufficient reaſon, we ſhould have many more genera to add to the bivalves, particularly the ſnails of ſeveral kinds.

The buccina generate in warm months, and ſome

ſpecies of them have been frequently remaining in pairs together, upon the rocks, deſerted by the tide on that occaſion. Theſe have been thence ſuppoſed to be of a different genus, and have been called buccina littoralia; they are uſually found in copulation early in the morning.

TRUMPETER, in zoology, a name given in England to a particular ſpecies of pigeon, called by Moore the columba tibicen.

This ſpecies is of the middle ſize of the common pigeon, and made conſiderably like it; but it is pearly-eyed; is of a mottled black, and is feathered down to the legs and feet, and is turn-crowned like the nun, and ſome other ſpecies; ſometimes like the finnikin, but much larger: this ſeems to be the beſt ſort, as being the moſt melodious. The beſt character, to know them by, is a tuft of feathers growing at the root of the beak; and, the larger this tuft is, the more they are eſteemed. The reaſon of their name is, that they imitate in their cooing the ſound of the trumpet; but, to be often entertained with their melody, it is neceſſary to feed them frequently with hemp-ſeed. *Moore's Columbarium.*

Feaſt of TRUMPETS, an annual feſtival of the Jews, expreſsly enjoined by the law of Moſes, and obſerved upon the firſt day of the ſeventh month, called Tiſri, which was the beginning of the civil year.

This feſtival is expreſsly called a ſabbath, and was a very ſolemn day, on which no ſervile work was to be done; only proviſion made for their meals, which were uſually very plentiful at this time. Among other diſhes, they ſerved up a ram's head, in memory of that ram which was ſacrificed in the room of Iſaac; which they fancy was done upon this day. All the feſtivals of the Jews, it is true, were introduced by the ſound of trumpets: but this was attended with more than uſual ſolemnity; for they began to blow at ſun-riſing, and continued till ſun-ſet. And whereas, in other places, the beginning of the year was ſounded with a trumpet of ram's or ſheep's horn, at the temple they uſed two ſilver trumpets, and the Levites upon that day ſung the eighty-firſt pſalm.

This feſtival is called "A memorial of blowing of trumpets:" but it is not ſo eaſy to determine what this blowing of trumpets was a memorial of. Maimonides will have it to be inſtituted, to awaken the people out of ſleep, and call them to repentance; being intended to put them in mind of the great day of expiation, which followed nine days after. Baſil imagined, that by theſe ſoundings the people were put in mind of that day, wherein they received the law from Sinai with blowing of trumpets. Others think it more probable, that ſince all nations made great ſhouting, rejoicing, and feaſting, in the beginning of the year, at the firſt new-moon, in hopes that the reſt of the year by this means would prove more proſperous, God was pleaſed to ordain this feſtival among his people, in honour of himſelf, upon the day of the firſt new-moon, to preſerve them from idolatry, and to make them ſenſible, that he alone gave them good years. Others again imagine, that God marked this month with a peculiar honour, becauſe it was the ſeventh; that, as every ſeventh day was a ſabbath, and every ſeventh year the land reſted, ſo every ſeventh month of every year ſhould be a kind of ſabbatical month: and upon that account the people might be awakened by this blowing of trumpets, to obſerve this feſtival with the proper ceremonies. Laſtly, others explain this blowing of trumpets to be a memorial of the creation of the world, which was in autumn. Upon this account it was that they antiently began their years at this time, as the eaſtern people do at this day. By this means they alſo confeſſed the divine goodneſs in bleſſing the year paſt, and bringing them to the beginning of a new year, which they prayed that God would make happy and propitious to them.

The ſacrifices to be offered upon this day were, the daily burnt-ſacrifice; then the ſacrifices appointed for the firſt day of every month; then the proper ſacrifices, over and above the reſt, appointed for the firſt day of the ſeventh month, which conſiſted of a bullock, a ram, and ſeven lambs for burnt-offerings, and a goat for a ſin-offering.

The modern Jews, upon this feſtival, make better chear than ordinary, and ſound the trumpet thirty times ſucceſſively. Eight days before the feaſt, they apply themſelves to works of mortification and penance; and, the evening before, many of them receive thirty-nine blows with a whip, by way of diſcipline. This they do upon an opinion, that on this day God judges of the actions of the foregoing year, and diſpoſes of the events of the year following. They uſe to each other this form of ſalutation, "May you be written in a good year;" to which the anſwer is, "And you alſo." Some go to the ſynagogue cloathed in white, as a token of purity and penance; and among the Germans, ſome wear the habit appointed for their burial, as a ſign of mortification. Others plunge themſelves in cold water, and, as they ſink, beat their breaſts, and confeſs their ſins.

TRUNCATED, in general, an appellation given to ſuch things as have, or ſeem to have, their points cut off: thus we ſay, a truncated cone, pyramid, leaf, &c.

TRUNCHEON, a ſhort ſtaff, or battoon, uſed by kings, generals, and great officers, as a mark of their command.

TRUNDLE, a ſort of carriage with low wheels, whereon heavy and cumberſome burdens are drawn.

TRUNDLE-SHOT. See the article SHOT.

TRUNK, *Truncus*, among botaniſts, denotes the ſtem, or body, of a tree; or, that part between the ground and the place where it divides into branches.

In anatomy, trunk is uſed for the buſto of a human body, excluſive of the head and limbs, comprehending the abdomen and thorax. See the article ABDOMEN and THORAX.

Trunk is alſo uſed for the main body of an artery, or vein, in contradiſtinction to the branches and ramifications thereof.

Trunk-roots of a plant, are little roots which grow out of the trunks of plants.

Theſe are of two kinds: 1. Such as vegetate by a direct deſcent, the place of their eruption being ſometimes all along the trunk, as in mints, &c. and ſometimes only in the utmoſt point, as in brambles.

2. Such as neither aſcend nor deſcend, but ſhoot forth at right angles to the trunk; which therefore, though as to their office they are true roots, yet, as to their nature, are a medium between a trunk and a root.

TRUNNIONS, or TRUNIONS *of a piece of Ordnance*, are thoſe knobs or bunches of the gun's metal, which bear her up on the cheeks of the carriage: and hence the trunnion-ring is the ring about a cannon, next before the trunnions.

TRUSS, *Truſſa*, a bundle, or certain quantity of hay, ſtraw, &c.

A truſs of hay is to contain fifty-ſix pounds, or half an hundred weight; thirty-ſix truſſes make a load. In June and Auguſt the truſs is to weigh ſixty pounds, on forfeiture of eighteen ſhillings per truſs.

A truſs of forage is as much as a trooper can carry on his horſe's crupper.

TRUSS *of Flowers*, is uſed, by floriſts, to ſignify many flowers growing together on the head of a ſtalk, as in the cowſlip, auricula, &c.

TRUSS is alſo uſed for a ſort of bandage or ligature, made of ſteel, or the like matter, wherewith to keep up the parts, in thoſe who have hernias or ruptures.

In plate CXXXII. *fig.* 22. &c. are repreſented various kinds of truſſes, to compreſs the parts, and prevent a relapſe of the inteſtine after the rupture has been cured. Some of theſe, as *fig.* 24, 29, and 30, are made of calicoe, for infants; or of leather, for adults. Others, as *fig.* 22, 24, 25, and 32, are made of ſteel covered with leather. Some are made of ſteel-plates, joined by hinges, ſo as to be flexible and more eaſy, as in *fig.* 32. Some again are deſigned for ruptures on both ſides; as *fig.* 25. and 26. Some are for ruptures on the right ſide, as *fig.* 23, and 24: others for the left; as 22, 30, 31, and 32. Some, again, are faſtened to the body by tagged-laces; as *fig.* 26, 27, and 30: others by ſtraps and buckles; as *fig* 23, 26, and 30: others by hooks and eyes, or hooks and ſtraps; as *fig.* 22, 24, and 25: and others again by different contrivances; as in *fig.* 28, and 29.

Fig. 1. Triangle.

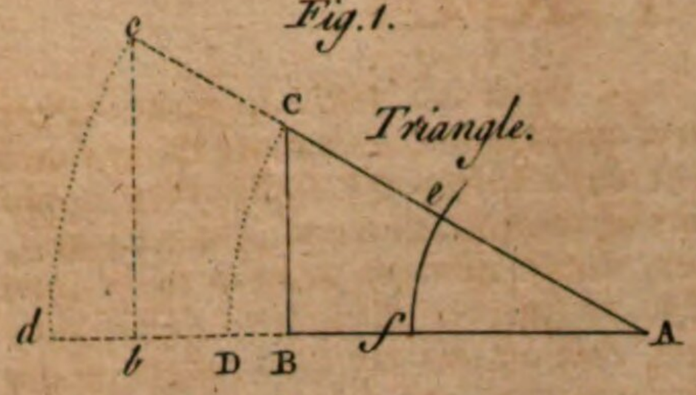


Fig. 2. Trigonometry.

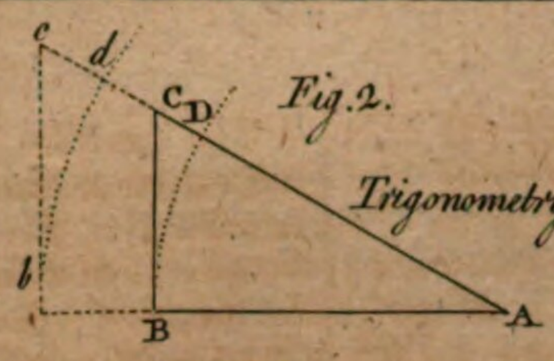


Fig. 4. Trigonometry.

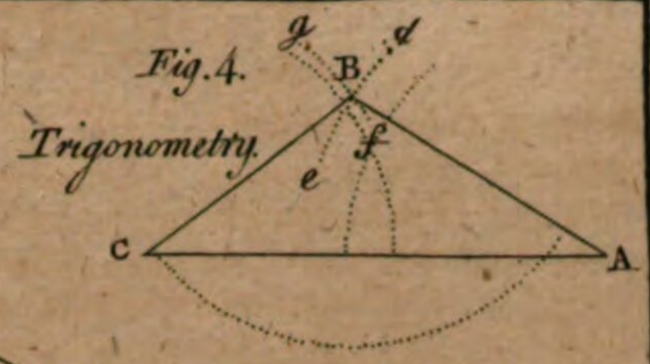


Fig. 5.

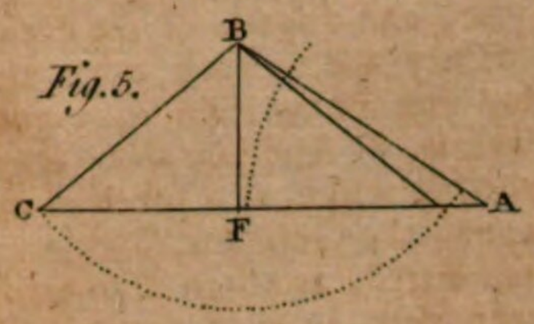


Fig. 6.

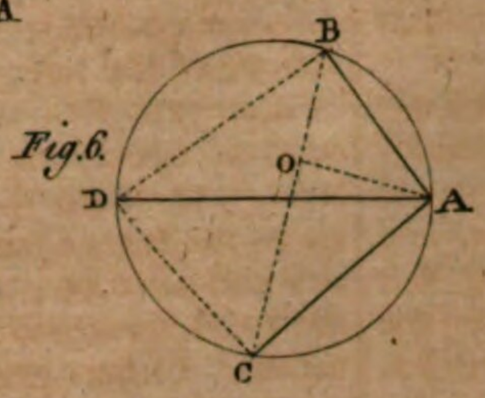
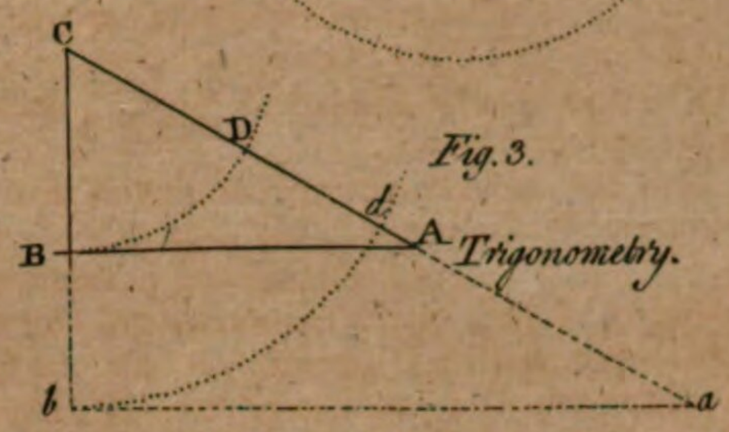


Fig. 3. Trigonometry.



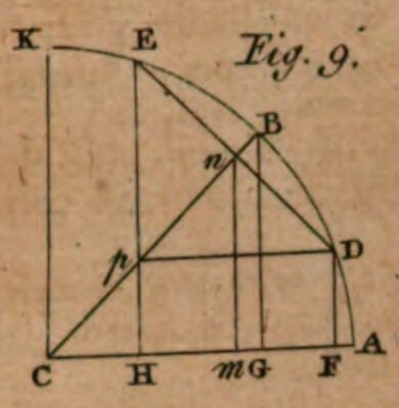


Fig. 9.

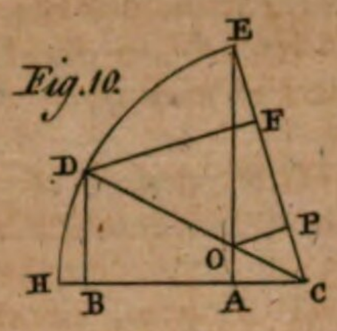


Fig. 10.

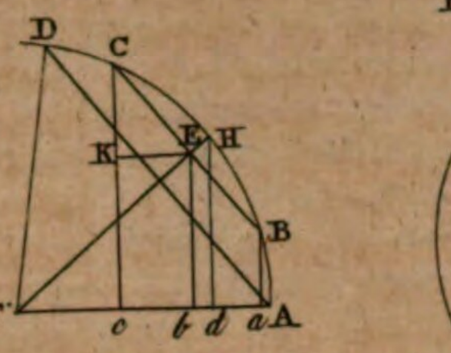


Fig. 7

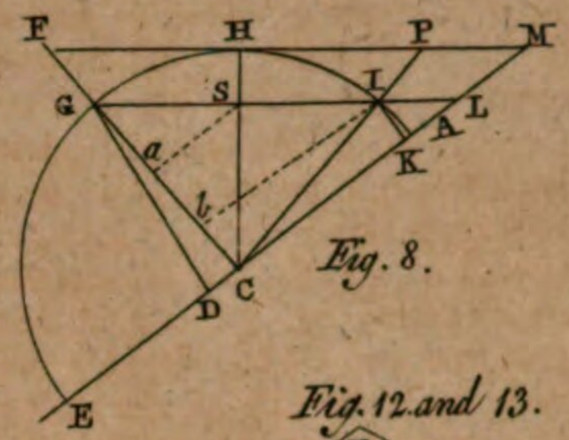


Fig. 8.

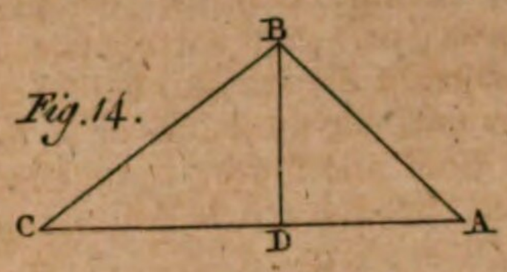


Fig. 14.

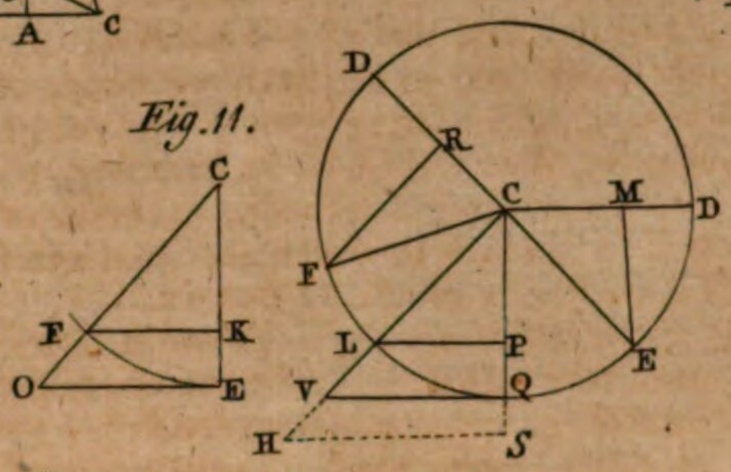
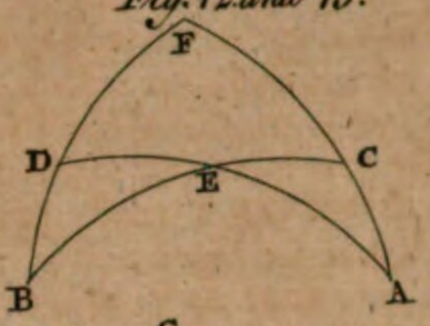


Fig. 11.

Fig. 12. and 13.



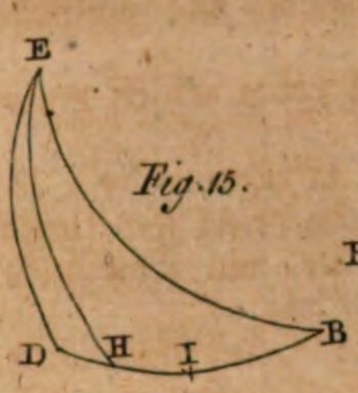


Fig. 15.

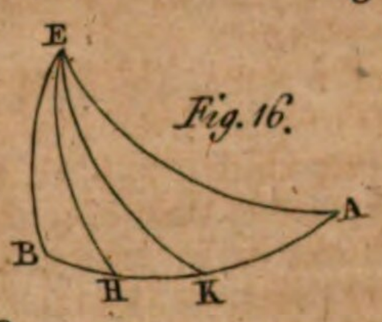


Fig. 16.

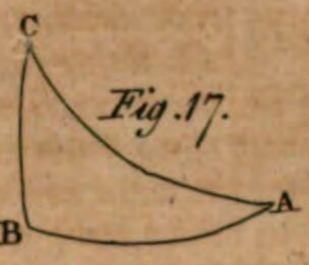


Fig. 17.

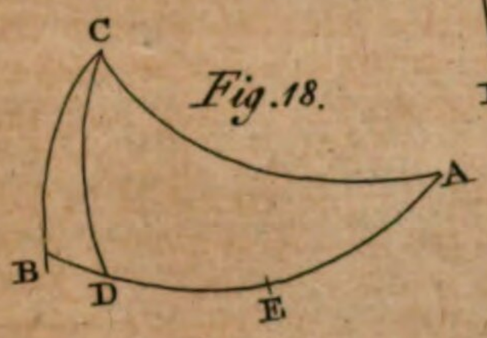


Fig. 18.

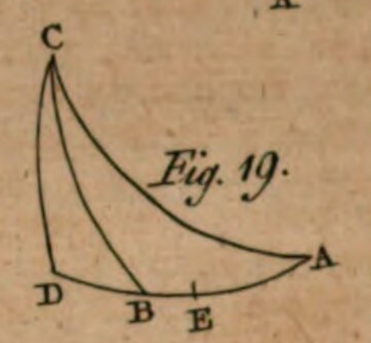


Fig. 19.

Fig. 20.

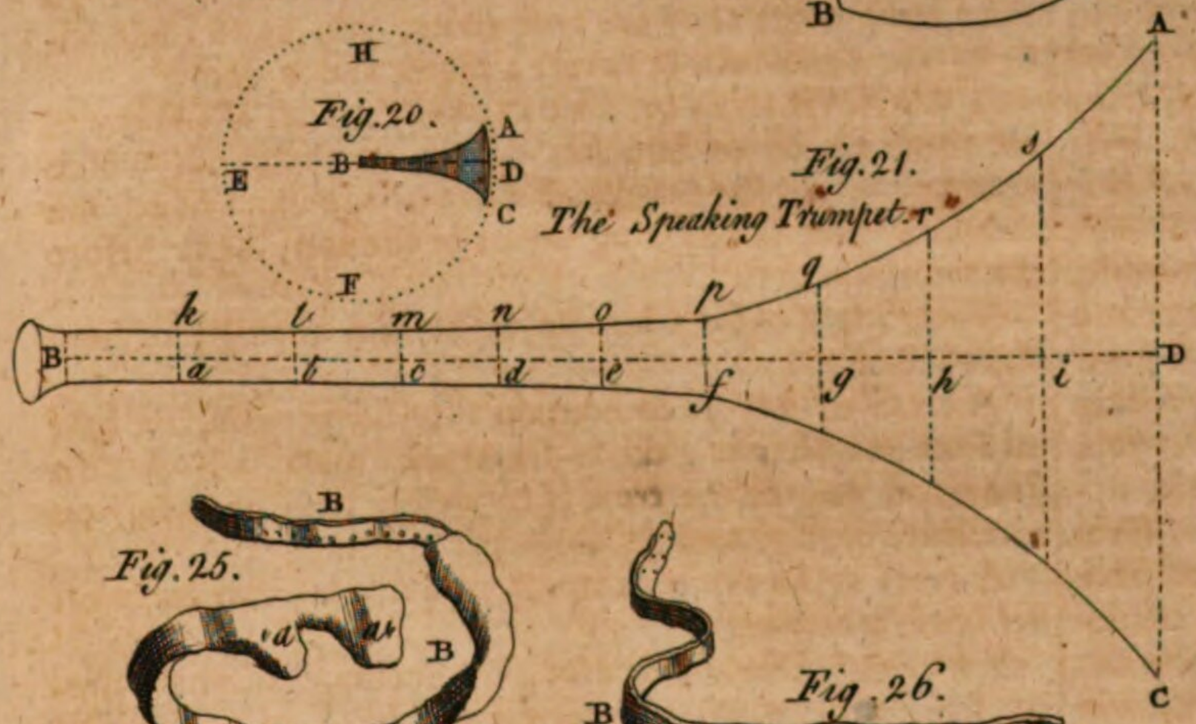


Fig. 21. The Speaking Trumpet.

Trusses.

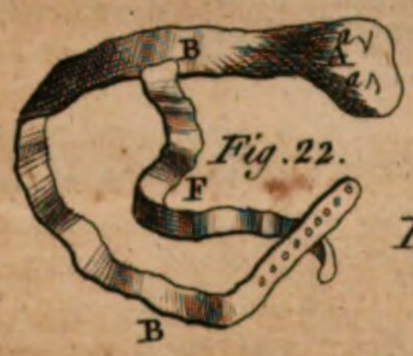


Fig. 22.

Fig. 23.

Fig. 24.

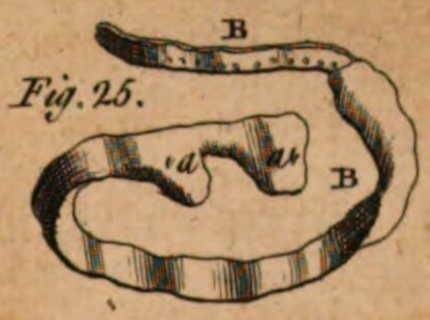


Fig. 25.

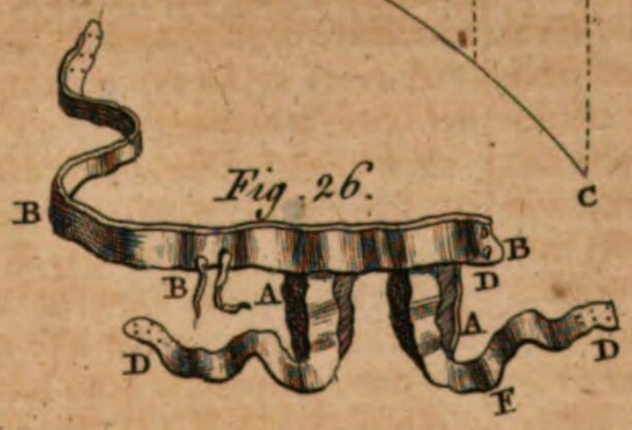


Fig. 26.

Fig. 27.

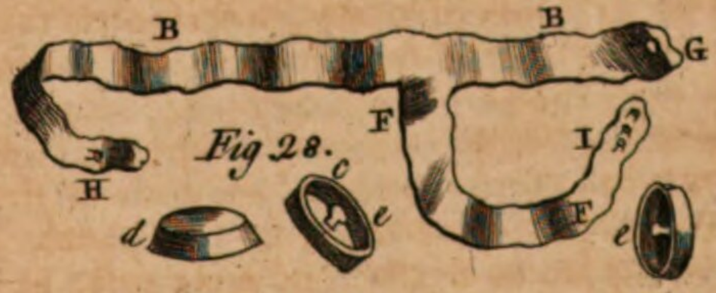


Fig. 28.

Fig. 29.

Fig. 30.

Fig. 31.

Fig. 32.

In all theſe truſſes, A denotes the bolſter or compreſs, which is applied to the ring of the abdominal muſcles, after the rupture has been reduced: B B the girdle or belt of the truſs, to be faſtened round the body, either with ſtrings C C, paſſed through the holes D D; or by ſtraps and buckles, as in *fig.* 23, and 31, marked E E: or with hooks, as in *fig.* 22, 24, 25, and 32, marked *a a*. In many of theſe truſſes there is a depending girt, beſides that which paſſes round the body, which is to be paſſed between the legs of women, and faſtened to the oppoſite part of the belt: as F F in *fig.* 22, 24, 27, 28, 29, 30, and 31. In *fig.* 27, is ſhewn the bolſter *a*; and in *fig.* 28, may be ſeen a wooden bolſter *c d*, *e e* being the button by which it is faſtened to the truſs, and *d* the convex part by which it is applied to the rupture.

There are a multitude of other truſſes, of various forms, contrived by thoſe who make it their buſineſs; but we have here given figures of the beſt of them.

TRUSSES, in a ſhip, are ropes made faſt to the parrels of a yard, either to bind the yard to the maſt when the ſhip rolls, or to hale down the yards in a ſtorm, &c.

TRUSSING, in falconry, is a hawk's raiſing any fowl, or prey, aloft; firſt ſoaring up, and then deſcending with it to the ground.

TRUST, in law, ſignifies, in general, that confidence which one perſon repoſes in another; and in caſe of non-performance, or breach of this truſt, the remedy is by bill in equity, as the common-law uſually takes no notice of truſts.

Conveyances made in the way of truſt, which were formerly invented to evade the ſtatute of uſes, are not ſo much favoured as plain and direct deeds. All declarations of truſts of lands, &c. are to be in writing, and ſigned by the parties. It has been decreed in Chancery, that a fine and recovery of a ceſtuiqui truſt ſhall bar and transfer the eſtate, as they ſhould an eſtate at law, where the ſame were levied or ſuffered on good conſideration. And there is a ſtatute whereby an infant ſeized of an eſtate in fee in truſt, is enabled to make any conveyance thereof, by order of the court of Chancery.

TRUSTEE, one who has an eſtate, or money, put or truſted in his hands, for the uſe of another.

Where two or more perſons are appointed truſtees, if one of them only receives all or the greateſt part of the profits of the lands, &c. and is in arrear, and unable to ſatisfy the perſon to whom he is ſeiſed in truſt, the other, in that caſe, ſhall not be anſwerable for more than comes to his hands.

TRUTH, *Veritas*, a term uſed in oppoſition to falſehood, and applied to propoſitions which anſwer, or accord, to the nature and reality of the thing of which ſomething is affirmed or denied.

Truth, according to Mr. Locke, conſiſts in the joining or ſeparating of ſigns, as the things ſignified by them do agree or diſagree one with another. Now the joining or ſeparating of ſigns is what we call making of propoſitions. Truth then, properly relates only to propoſitions, of which there are two ſorts, mental and verbal; as there are two ſorts of ſigns commonly made uſe of, viz. ideas and words.

Mental propoſitions are thoſe wherein the ideas in our underſtanding are put together, or ſeparated, by the mind perceiving or judging of their agreement or diſagreement.

Verbal propoſitions are words put together, or ſeparated, in affirmative or negative ſentences: ſo that a propoſition conſiſts in joining or ſeparating of ſigns; and truth conſiſts in putting together, or ſeparating thoſe ſigns, according as the things they ſtand for agree or diſagree.

Moral TRUTH conſiſts in ſpeaking things according to the perſuaſion of our minds, and is called alſo veracity.

Metaphyſical, or *Tranſcendental* TRUTH, is nothing but the real exiſtence of things conformable to the ideas which we have annexed to their names.

TRUTINATION, the act of weighing or ballancing a thing. See BALLANCE.

TRY, in the ſea-language. A ſhip is ſaid to try, or lie a-try, when no ſails are abroad but the main-ſail, or mizzen-ſail.

TSIN, in natural hiſtory, the name given by the Chineſe to a ſtone which they make great uſe of in their manufacture of porcelain ware. It is of a deep blue colour, much reſembling Roman vitriol in appearance, and is found in lead mines, and ſuppoſed to contain ſome particles of lead; its effects being the ſame in the porcelain manufacture as thoſe of ceruſs or white lead, in making the other colours penetrate into the ſubſtance of the veſſels. The deep violet colour that we ſee ſo beautiful on the China ware, is uſually made with this ſtone. They find it about Canton and Peking; but the latter place affords the beſt, and it ſells at greatly the beſt price. The painters in enamel melt this ſtone in their way, and uſe it very much; they form many beautiful works by laying it upon ſilver; but it is too apt to come off in time.

When the tſin is uſed in the porcelain manufacture, it is only uſed to the vaſes that paſs a ſecond baking, and are intended as the beſt kinds.

The tſin is prepared by only beating it to powder, not roaſting it in the common way. They mix the powder with large quantities of water; and, ſtirring it together, they let it ſubſide a little to ſeparate any earthy or extraneous matter that might be among it. They then let the powder ſubſide. The water which is thrown away has no colour from this matter; and the powder itſelf is not of that fine blue it was in the lump, but of a pale aſh-colour; but this recovers all its beauty, when it is laid on the china and baked.

The ſettlement taken from the water is dried and preſerved in powder, and, when it is to be uſed, they only mix it up with gum-water, or a ſolution of glue, and lay it on with a pencil.

TUB, in commerce, denotes an indeterminate quantity or meaſure: thus, a tub of tea contains about ſixty pounds; and a tub of camphor from fifty-ſix to eighty pounds.

TUBBER, or TUBBLE, in mining, a name given in Cornwall to that mining inſtrument, which is in other parts of England called a beele.

It is an iron inſtrument, pointed at each end, and having a hole in the middle for the handle.

TUBE, *Tubus*, in general, a pipe, conduit, or canal; a cylinder hollow within ſide, either of lead, iron, wood, glaſs, or other matter, for the air or ſome other fluid to have a free paſſage or conveyance through.

Small ſilver or leaden tubes are frequently uſed by ſurgeons to draw off blood, matter, or water, from the different parts of the body. They are made of various ſizes and ſhapes, as repreſented in plate CXXXIV. *fig.* 1. at the letters P, Q, R, S, T, V, X; the uſes of which will be ſhewn at large under the articles WOUND, PARACENTESIS, &c.

TUBE, in aſtronomy, is ſometimes uſed for a teleſcope, or, more properly, for that part thereof into which the lenſes are fitted, and by which they are directed and uſed. The goodneſs of the tube being of great importance to that of the teleſcope, we ſhall here add its ſtructure.

*The Conſtruction of a Draw-*TUBE *for a Teleſcope.* The chief points to be regarded here are, that the tube be not troubleſome by its weight, nor liable to warp and diſturb the poſition of the glaſſes; ſo that every kind of tube will not ſerve in every caſe.

1. If the tube be ſmall, it is beſt made of thin braſs-plates covered with tin, and formed into pipes or draws, to ſlide within one another. 2. For long tubes, iron would be too heavy, for which reaſon ſome chooſe to make them of paper, thus: a wooden cylinder is turned, of the length of the paper to be uſed, and of a diameter equal to that of the ſmalleſt draw: about this cylinder is rolled paper till it be of a ſufficient thickneſs; when one pipe is dry provide others, after the ſame manner, ſtill making the laſt ſerve for a mould to the next, till you have enough for the length of the tube deſired. Laſtly, to the extremes of the draws are to be glewed wooden ferrils, that they may be drawn forth the better.

3. Since paper draws are apt to ſwell with moiſt weather, ſo as to ſpoil their ſliding; and in dry weather to ſhrink, which renders them looſe and tottering; in both which caſes the ſituation of the lens is eaſily diſturbed; the beſt method of making of tubes is as follows: Glue

parchment round a wooden cylinder, and let the parchment be coloured black, to prevent the reflecting rays making any confuſion: provide very thin ſlits of beech, and bending them into a cylinder glue them carefully to the parchment; cover this wooden caſe with white parchment, and, about its outer extreme, make a little ring or ferril: after the ſame manner, make another draw over the former, and then another, till you have enough for the length of the tube.

To the inner extremes of each draw fit a wooden ferril, that the ſpurious rays, ſtriking againſt the ſides, may be intercepted and loſt. In theſe places where the lenſes are to be put, it will be proper to furniſh the ferrils with female ſcrews. Provide a wooden cover to defend the object-glaſs from the duſt; and, putting the eye-glaſs in its wooden ferril, faſten it by the ſcrew to the tube. Laſtly, provide a little wooden tube of a length equal to the diſtance the eye-glaſs is to be from the eye, and fit it to the other extreme of the tube.

TUBER, or TUBERCLE, in botany, a kind of round turgid root, in form of a knob or turnip.

The plants which produce ſuch roots are hence denominated tuberoſe, or tuberous, plants.

TUBER, or TUBEROSITY, in medicine, is uſed for a knob, or tumour, growing naturally in any part; in oppoſition to tumours, which ariſe accidentally, or from diſeaſe.

TUBERCLES, among phyſicians, denote little tumours which ſuppurate and diſcharge pus, and are often found in the lungs, eſpecially of conſumptive perſons.

TUBEROSE, *Polianthes*, in botany. See POLIANTHES.

The varieties of this plant are the tuberoſe with a double flower, the ſtriped-leaved tuberoſe, and the tuberoſe with a ſmaller flower; the laſt is mentioned by ſeveral authors as a diſtinct ſpecies, but is certainly a variety.

This ſort is frequent in the ſouth of France, from whence the roots have been often brought to England early in the ſpring, before thoſe roots have arrived from Italy, which are annually imported; the ſtalks of this are weaker, and do not riſe ſo high, and the flowers are ſmaller than thoſe of the common tuberoſe, but in other reſpects is the ſame.

The tuberoſe grows naturally in India, from whence it was firſt brought to Europe, where it now thrives in the warmer parts, as well as in its native ſoil. The Genoeſe are the people who cultivate this plant, to furniſh all the other countries where the roots cannot be propagated without great trouble and care, and from thence the roots are annually ſent to England, Holland, and Germany. In moſt parts of Italy, Sicily, and Spain, the roots thrive and propagate without care, where they are once planted.

This plant has been long cultivated in the Engliſh gardens, for the exceeding beauty and fragrancy of its flowers; the roots of this are annually brought from Genoa, by the perſons who import orange trees; for as theſe roots are too tender to thrive in the full ground in England, ſo there are few perſons who care to take the trouble of nurſing up their off-ſets, till they become blowing roots, becauſe it will be two or three years before they arrive to a proper ſize for producing flowers; and as they muſt be protected from the froſt in winter, the trouble and expence of covers is greater than the roots are worth; for they are generally ſold pretty reaſonable, by thoſe who import them from Italy.

The double flowering is a variety of the firſt, which was obtained from ſeed by Monſ. Le Cour, of Leyden in Holland, who for many years was ſo tenacious of parting with any of the roots, even after he had propagated them in ſuch plenty, as to have more than he could plant, that he cauſed them to be cut in pieces, that he might have the vanity to boaſt of being the only perſon in Europe who was poſſeſſed of this flower; but of late years the roots have been ſpread into many parts; and as there is no method to propagate this but by the off ſets, moſt people who have had of this ſort, are careful to multiply and increaſe it, which is done by planting the off-ſets upon a moderate hot-bed early in March, and covering the bed in cold weather with mats or ſtraw; in ſummer they muſt have plenty of water in dry weather. In this bed the roots may remain till the leaves decay in autumn; but if there ſhould happen any froſt before that time, the bed ſhould be covered to guard the roots from the froſt, becauſe if the froſt enters ſo low as to reach the roots, it will kill them; and if the leaves are injured by the froſt, it will weaken the roots. Where there is a due care taken to ſcreen them from froſt, and too much wet, it will be the beſt way to let the roots remain in the bed till the end of November, or the beginning of December, provided hard froſts do not ſet in ſooner; for the leſs time the roots are out of the ground, the ſtronger they will be, and the ſooner they will flower. When the roots are taken up, they ſhould be cleaned from the earth, and laid up in dry ſand, where they may be ſecure from froſt and wet; here they ſhould remain until the ſeaſon for planting them again: this ſame method ſhould be practiſed by thoſe who are deſirous to cultivate the ſingle ſort in England, and alſo that with ſtriped leaves muſt be propagated the ſame way.

We ſhall next give directions for the management of thoſe roots which are annually brought from Italy. And firſt, in the choice of the roots, thoſe which are the largeſt and plumpeſt, if they are perfectly firm and ſound, are the beſt, and the fewer off-ſets they have, the ſtronger they will flower; but the under part of the roots ſhould be particularly examined, becauſe it is there that they firſt decay. After the roots are choſen, before they are planted, the off-ſets ſhould be taken off; for if theſe are left upon the roots, they will draw away part of the nouriſhment from the old root, whereby the flower-ſtems will be greatly weakened.

As the roots commonly arrive in England in the month of February or March, thoſe who are deſirous to have theſe early in flower, ſhould make a moderate hot-bed ſoon after the roots arrive, which ſhould have good rich earth laid upon the dung, about ſeven or eight inches deep; this bed ſhould be covered with a frame, and when the bed is in a proper temperature for warmth, the roots ſhould be planted at about ſix inches diſtance from each other every way. The upper part of the root ſhould not be buried more than one inch in the ground; when the roots are planted, there ſhould be but little water given them, until they ſhoot above ground, for too much wet will rot them, when they are in an inactive ſtate, but afterward they will require plenty of water, eſpecially when the ſeaſon is warm. When the flower ſtems begin to appear, the bed ſhould have a large ſhare of air given to it; otherwiſe the ſtalks will draw up weak, and produce but few flowers; for the more air theſe plants enjoy in good weather, the ſtronger they will grow, and produce a great number of flowers; therefore, towards the beginning of May, the frame may be quite taken off the bed, and hoops faſtened over it, to ſupport a covering of mats, which need not be laid over but in the night, or in very cold weather, ſo that by enjoying the free open air, their ſtems will be large; and if they are well watered in dry weather, their flowers will be large, and a great number on each ſtem.

The firſt planting will require more care than thoſe which are deſigned to come after them; for in order to have a ſucceſſion of theſe flowers, the roots ſhould be planted at three different times, viz. the firſt the beginning of March, the ſecond the beginning of April, and the third at the end of that month, or the beginning of May; but the latter beds will require a much leſs quantity of dung than the firſt, eſpecially that bed which is the laſt made; for if there is but warmth enough to put the roots in motion, it is as much as will be required; and this laſt bed will need no covering, for many times thoſe roots which are planted in the full ground at this ſeaſon, will produce ſtrong flowers in autumn; but in order to ſecure their flowering, it is always the beſt way to plant them on a gentle hot-bed. As to the ſecond bed, that ſhould be arched over with hoops, and covered with mats every night, and in bad weather, otherwiſe the late froſts which frequently happen in May, will pinch them.

Theſe plants may remain in the beds until the flowers are near expanding, at which time they may be carefully

fully taken up, preſerving the earth to their roots, and planted in pots, and then placed in the ſhade for about a week to recover their removal; after which time the pots may be removed into halls, or other apartments, where they will continue in beauty a long time, and their fragrant odour will perfume the air of the rooms where they are placed, and by having a ſucceſſion of them, they may be continued from Midſummer to the end of October, or middle of November; but as the ſtems of theſe plants advance, there ſhould be ſome ſticks put down by each root, to which the ſtem ſhould be faſtened, to prevent their being broken by the wind.

It is a common practice with many people, to plant theſe roots in pots, and plunge the pots into a hot-bed; but there is much more trouble in raiſing them in this method than in that before directed; for if the roots are not planted in very ſmall pots, there will be a neceſſity of making the beds much larger, in order to contain a quantity of the roots; and if they are firſt planted in ſmall pots, they ſhould be ſhaken out of theſe into pots of a larger ſize, when they begin to ſhoot out their flower ſtems, otherwiſe the ſtalks will be weak, and produce but few flowers; therefore the other method is to be preferred, as there is no danger in removing the roots, if it is done with care.

When the roots are ſtrong, and properly managed, the ſtems will riſe three or four feet high, and each ſtem will produce twenty flowers or more; and in this the great beauty of theſe flowers conſiſts, for when there are but a few flowers upon the ſtalks, they will ſoon fade away, and muſt be frequently renewed; for the flowers are produced in ſpikes coming out alternately upon the ſtalk, the lower flowers opening firſt; and as theſe decay, thoſe above them open; ſo that in proportion to the number of flowers upon each ſtalk, they continue in beauty a longer or ſhorter time.

The ſort with double flowers will require a little more care, in order to have the flowers fair; but this care is chiefly at the time of blowing, for the flowers of this ſort will not open, if they are expoſed to the open air; therefore when the flowers are fully formed and near opening, the pots ſhould be placed in an airy glaſs-caſe, or a ſhelter of glaſſes ſhould be prepared for them, that the dews and rains may not fall upon them, for that will cauſe the flowers to rot away before they open, and the heat of the ſun drawn through the glaſſes, will cauſe their flowers to expand very fair. With this management, Mr. Miller ſays he has had this ſort with very double flowers extremely fair, and upwards of twenty upon one ſtem, ſo that they have made a beautiful appearance; but where this has not been practiſed, it is very rare to ſee one of them in any degree of beauty.

TUBEROUS, or TUBEROSE-ROOTS, in botany. See TUBER.

TUBIPORA, or TUBULARIA, a genus of ſubmarine plants, belonging to the cryptogamia claſs, of the hardneſs of coral, and conſiſting of cylindric tubes riſing from a thin cruſt of the ſame ſort of matter with themſelves.

TUBULARIA FOSSILIS, in natural hiſtory, the name of a ſpecies of coral found very often foſſil in Germany and Italy, and compoſed of a great number of tubes, or longitudinal pipes, often reſembling ſo many worms ranged perpendicularly in the maſs. They are uſually found either in maſſes of a lax ſtone, or in ſingle tubules in thoſe of the harder and firmer texture. In theſe two ſtates, this foſſil makes two very different appearances; and, according to the different directions in the maſs, or the different views of them that the ſections of it place them in, they make a number of very elegant figures.

TUBULATED FLOWER, *Tubulatus Floſculus*, in botany, a term uſed by authors to expreſs thoſe ſmaller flowers, a great number of which go to compoſe one large compound flower. Theſe are called tubulated in diſtinction from another kind of them, which are from their ſhape called ligulated. The tubulated floſcules generally compoſe the diſk, and the ligulated ones the radius of the compound flowers. The tubulated ones are formed into a hollow cylinder, which expands into a mouth at the top, and is divided into five equal ſegments, which ſtand expanded, and in ſome meaſure bent backwards.

TUBULI FOSSILIS, in natural hiſtory, the tubules, or caſes of ſea-worms, found buried in the earth. They are met with of various ſizes, ſometimes complete, and buried in the ſtrata of earth or ſtone; ſometimes they are more or leſs perfect, and are immerſed in maſſes of the ludus helmontii or ſeptariæ, and in this ſtate they make one kind of lapis ſyringoides, or pipe-ſtone; but the moſt beautiful ſyringoides, or pipe-ſtones, are the parts of the bottoms of ſhips, or poſts fixed in the ſea, which have been pierced in their original ſtate of wood, by theſe ſea-worms, and afterwards petrified with the caſes or tubuli of the worms remaining in them; theſe are uſually of a pale-yellow or whitiſh wax colour, and the body of the maſs of a browniſh or blackiſh hue, but retaining the ſtructure of the wood: of theſe there are beautiful ſpecimens in great abundance on the ſhore of the iſland Sheppy. We have the very ſame ſubſtances alſo buried in our clay-pits, about London and at Richmond; but in theſe the wood is highly ſaturated with the matter of the common vitriolic pyrites, and the pipes often filled with the ſame ſubſtance.

TUBULI LACTIFERI, in anatomy, the ſmall tubes or veſſels, through which the milk flows to the nipples of women's breaſts.

TUBULUS MARINUS, or CANALIS, in natural hiſtory, a genus of univalve ſhells, of an oblong figure, terminating in a point, and hollow within, ſo as to reſemble a tube or horn; and hence have, by ſome old writers, been called dentalia.

Of theſe ſhells ſome are ſtriated, ſome ſtraight, ſome bent like a horn, and ſome in form of a creſcent.

TUCK *of a Ship*, the truſſing or gathering up the quarter under water; which if ſhe lie deep, makes her have a broad, or, as they call it, fat quarter, and hinders her ſteering, by keeping the water from paſſing ſwiftly to her rudder; and if this truſſing lie too high above the water, ſhe will want bearing for her works behind, unleſs her quarter be very well laid out.

TULIP, *Tulipa*, in botany, a genus of plants, the flower of which has no empalement; it is of the bell-ſhape, compoſed of ſix oblong, oval, concave, erect petals; it has ſix awl-ſhaped ſtamina, which are ſhorter than the petals, terminated by oblong four-cornered ſummits, and a large oblong, taper, three cornered germen, having no ſtyle, crowned by a triangular, three-lobed, permanent ſtigma. The germen afterwards turns to a three-cornered capſule, having three cells, which are filled with compreſſed ſeeds, lying over each other in a double order.

There are two ſpecies of tulips: the firſt ſort was formerly preſerved in the Engliſh gardens; but ſince there has been ſo many varieties of the ſecond ſort propagated in England, the firſt has been rejected, and is now only to be found in old neglected gardens. The petals of this flower end in acute points; the flower is yellow, and nods on one ſide, and the leaves are narrower than thoſe of the common ſort.

The common tulip is ſo well known as to need no deſcription; and it would be to little purpoſe to enumerate the ſeveral varieties of theſe flowers, which may be ſeen in one good garden, ſince there is no end of their numbers; and what ſome people may value at a conſiderable rate, others reject: beſides, there are annually a great variety of new flowers obtained from breeders, ſo thoſe which are old, if they have not very good properties to recommend them, are thrown out and deſpiſed. I ſhall therefore point out the properties of a good tulip, according to the characteriſtics of the beſt floriſts of the preſent age. 1. It ſhould have a tall ſtrong ſtem. 2. The flower ſhould conſiſt of ſix leaves, three within, and three without; the former ought to be larger than the latter. 3 Their bottom ſhould be proportioned to their top, and their upper part ſhould be rounded off, and not terminate in a point. 4. Theſe leaves, when opened, ſhould neither turn inward, nor bend outward, but rather ſtand erect, and the flower ſhould be of a middling ſize, neither over large, nor too ſmall. 5. The ſtripes ſhould be ſmall and regular, ariſing from the bottom of the flower; for if there are any remains of the

former

former ſelf-coloured bottom, the flower is in danger of loſing its ſtripes again. The chives ſhould not be yellow, but of a brown colour. When a flower has all theſe properties, it is eſteemed a good one.

Tulips are generally divided into three claſſes, according to their ſeaſons of flowering; as Præcoces, or early blowers, Medias, or middling blowers, and Serotines, or late blowers; but there is no occaſion for making any more diſtinctions than two, viz. early and late blowers.

The early blowing tulips are not near ſo fair, nor riſe half ſo high, as the late ones, but are chiefly valued for appearing ſo early in the ſpring; ſome of which will flower the end of February in mild ſeaſons, if planted in a warm border near a wall, pale, hedge, or other ſhelter, and a month after the others will ſucceed them; ſo that they keep flowering until the general ſeaſon for the late flowers to blow, which is towards the end of April.

The roots of the early-blowing tulips ſhould be planted the beginning of September in a warm border, near a wall, pale, or hedge, becauſe if they are put into an open ſpot of ground, their buds are in danger of ſuffering by morning froſts in the ſpring. The ſoil for theſe ſhould be renewed every year, where people intend to have them fair. The beſt ſoil for this purpoſe is that which is taken from a light loamy paſture, with the turf rotted amongſt it; and to this ſhould be added a fourth part of ſea-ſand. This mixture may be laid about eighteen inches deep, which will be ſufficient; for theſe need not be planted more than four or five inches deep at moſt. The off-ſets ſhould not be planted amongſt the blowing roots, but in a border by themſelves, where they may be planted pretty cloſely together, eſpecially if they are ſmall; but theſe ſhould be taken up when their leaves decay, in the ſame manner as the blowing roots, otherwiſe they would rot; for theſe are not ſo hardy as the late blowers, nor do they increaſe half ſo faſt as thoſe, ſo that a greater care is required to preſerve the off-ſets of them.

When theſe tulips come up in the ſpring, the earth upon the ſurface of the borders ſhould be gently ſtirred and cleared from weeds; and as the buds appear, if the ſeaſon ſhould prove ſevere, it will be of great ſervice to cover them with mats, for want of which many times they are blighted, and their flower-buds decay before they blow, which is often injurious to the roots, as alſo the cropping of the flowers ſo ſoon as they are blown, becauſe their roots, which are formed new every year, are not at that time arrived to their full magnitude, and are hereby deprived of proper nouriſhment.

If, when theſe flowers are blown, the ſeaſon ſhould prove very warm, it will be proper to ſhade them with mats, &c. in the heat of the day; as alſo if the nights are froſty, they ſhould be in like manner covered, whereby they may be preſerved a long time in beauty; but, when their flowers are decayed, and their ſeed veſſels begin to ſwell, they ſhould be broken off juſt at the top of the ſtalks, becauſe if they are permitted to ſeed, it will injure the roots.

When the leaves of theſe flowers are decayed, which will be before the late blowers are out of flower, their roots ſhould be taken up, and ſpread upon mats in a ſhady place to dry; after which they ſhould be cleared from their filth, and put up in a dry place, where vermin cannot come to them, until the ſeaſon for planting them again, being very careful to preſerve every ſort ſeparate, that you may know how to diſpoſe of them at the time for planting them again, becauſe it is the better way to plant all the roots of each ſort together, and not to intermix them, as is commonly practiſed in moſt other kinds of flowers; for as there are few of them which blow at the ſame time, ſo, when the ſeveral roots of one ſort are ſcattered through a whole border, they make but an indifferent appearance; whereas, when twenty or thirty roots of the ſame ſort are placed together, they will all flower at the ſame time, and have a better effect.

There are many curious perſons, who, in order to preſerve their ſeveral kinds of tulips, and other bulbous-rooted flowers ſeparate, have large flat boxes made, which are divided into ſeveral ſmall partitions, each of which is numbered in the ſame manner as the diviſions of their beds; ſo that when a catalogue of their roots is made, and the numbers fixed to each ſort in the beds, there is nothing more to do when the roots are taken up, but to put every kind into the diviſion marked with the ſame number which was placed to each ſort in the bed, which ſaves a great deal of trouble, and effectually anſwers the purpoſe of preſerving the kinds ſeparate.

The late-blowing tulips are ſo numerous, that, as I before obſerved, it would be to no purpoſe to attempt to give a catalogue of them. Theſe are generally obtained from breeders, which is a term applied to all ſuch flowers as are produced from ſeeds which are of one ſelf-colour, and have good bottoms and chives; theſe in time break into various beautiful ſtripes, according to the ground of their former ſelf-colour; but this muſt be entirely thrown off, otherwiſe they do not eſteem a flower well broken.

Of theſe breeders there hath been a great variety brought into England from Flanders of late years, which is the grand nurſery for moſt ſorts of bulbous-rooted flowers; but there are ſome curious perſons, who have lately obtained many valuable breeders from ſeed in England; and doubtleſs, were we as induſtrious to ſow the ſeeds of theſe flowers as the people of Holland and Flanders, we might in a few years have as great variety as is to be found in any part of Europe; for, although it is ſix or ſeven years from the ſowing before theſe flowers blow, yet, if after the firſt ſowing there is every year a freſh parcel ſown, when the ſeven years are expired, there will be conſtantly a ſucceſſion of roots to flower every year, which will reward the expectation, and keep up the ſpirit of raiſing; but it is the length of time at firſt, which deters moſt people from this work.

The manner of propagating theſe flowers from ſeeds is as follows: you ſhould be careful in the choice of the ſeeds, without which there can be little ſucceſs expected. The beſt ſeed is that which is ſaved from breeders which have all the good properties before related, for the ſeeds of ſtriped flowers ſeldom produce any thing that is valuable.

The beſt method to obtain good ſeeds is to make choice of a parcel of ſuch breeding tulip roots as you would ſave ſeeds from, and plant them in a ſeparate bed from the other breeders, in a part of the garden where they may be fully expoſed to the ſun, obſerving to plant them at leaſt eight or nine inches deep; for if they are planted too ſhallow, their ſtems are apt to decay before their ſeed is perfected.

Theſe flowers ſhould always be expoſed to the weather, for if they are ſhaded with mats, or any other covering, it will prevent their perfecting the ſeed. About the middle of July, a little ſooner, or later, as the ſummer is hotter or colder, the ſeeds will be fit to gather, which may be known by the dryneſs of their ſtalks, and the opening of the ſeed veſſels; at which time it may be cut off, and preſerved in the pods till the ſeaſon for ſowing it, being careful to put it up in a dry place, otherwiſe it will be ſubject to mould, which will render it good for little.

Having ſaved a parcel of good ſeed, about the beginning of September is the beſt ſeaſon for ſowing it, when there ſhould be provided a parcel of ſhallow ſeed pans or boxes, ſix or eight inches deep, which ſhould have holes in their bottoms to let the moiſture paſs off; theſe muſt be filled with freſh light earth, laying the ſurface very even, upon which the ſeeds ſhould be ſown as regularly as poſſible, that they may not lie upon each other; then there ſhould be ſome of the ſame light earth ſifted over them; about half an inch thick. Theſe boxes or pans ſhould be placed where they may have the morning ſun till eleven of the clock, in which ſituation they may remain until the middle of October, at which time they ſhould be removed into a more open ſituation, where they may enjoy the benefit of the ſun all the day, and be ſheltered from the north winds, where they ſhould remain until winter, when they muſt be placed on a ſouth border, to ſcreen them from froſt; but in the ſpring, when the plants are up, they ſhould be again removed to their firſt ſituation; and if the ſeaſon ſhould be dry, they muſt be refreſhed with water, while the

plants remain green, but as ſoon as their tops begin to decay, there muſt be no more given them, leſt it rot their tender bulbs; therefore the boxes ſhould be placed in a ſhady ſituation during the ſummer ſeaſon, but not under the drip of trees.

Theſe plants, at their firſt appearance, have very narrow graſſy leaves, very like thoſe of onions, and come up with bending heads, in the ſame manner as they do; ſo that perſons who are unacquainted with them, may pull them up inſtead of graſs, whilſt they are very young, before their leaves are a little more expanded; which is not performed the firſt year, for they ſeldom appear before the middle of March; and they commonly decay about the latter end of May, or the beginning of June, according as the ſeaſon is hotter or colder.

The weeds and moſs ſhould alſo be cleared off from the ſurface of the earth in the boxes, and a little freſh earth ſifted over them ſoon after their leaves decay, which will be of great ſervice to the roots. Theſe boxes ſhould be conſtantly kept clear from weeds, which, if permitted to grow therein, when they are pulled up, their roots will be apt to draw the bulbs out of the ground. At Michaelmas they ſhould be freſh earthed again, and as the winter comes on, they muſt be again removed into the ſun as before, and treated in the ſame manner, until the leaves decay, when the bulbs ſhould be carefully taken up, and put in a cool ſhady room till the end of Auguſt, when they ſhould be planted in beds of freſh ſandy earth, which ſhould have tiles laid under them, to prevent the roots from ſhooting downward, which they often do when there is nothing to ſtop them, and thereby they are deſtoyed. The earth of theſe beds ſhould be about five inches thick upon the tiles, which will be ſufficient for nouriſhing theſe roots while they are young.

The diſtance which theſe young bulbs ſhould be allowed, need not be more than two inches, nor ſhould they be planted above two inches deep; but towards the end of October it will be proper to cover the bed over with a little tanner's bark, about two inches deep, which will preſerve the roots from the froſt, and prevent moſs or weeds from growing over them; but, if the winter ſhould be very ſevere, it will be proper to cover the bed either with mats or peaſe-haulm, to prevent the froſt from entering the ground, becauſe theſe roots are much tenderer while young, than they are after they have acquired ſtrength.

In the ſpring the ſurface of the ground ſhould be gently ſtoned to make it clean, before the plants come up; and if the ſpring ſhould prove dry, they muſt be frequently refreſhed with water, during the time of their growth; but this muſt not be given to them in great quantities, leſt it rot their tender bulbs; and when the leaves are decayed, the roots ſhould be taken up and treated in the ſame way as before.

When the bulbs are large enough to blow, they ſhould be planted in freſh beds at the diſtance, and in the ſame manner as old roots, where, when they flower, ſuch of them as are worthy to be preſerved ſhould be marked with ſticks; and at the ſeaſon for taking up the bulbs, they muſt be ſeparated from the others, in order to be planted as breeders in different beds; but you ſhould by no means throw out the reſt until they have flowered two or three years, becauſe it is impoſſible to judge exactly of their value in leſs time; for many, which at firſt flowering appear beautiful, will afterwards degenerate ſo as to be of little value; and others, which did not pleaſe at firſt, will many times improve, ſo that they ſhould be preſerved until their worth can be well judged of.

Having thus given an account of the method of raiſing theſe flowers from ſeeds, I ſhall now proceed to the management of the roots which are termed breeders, ſo as to have ſome of them every year break out into fine ſtripes.

There are ſome who pretend to have a ſecret how to make any ſort of breeders break into ſtripes whenever they pleaſe; but this, I dare ſay, is without foundation; for from many experiments which I and others have made of this kind, I could never find any certainty in this. All that can be done by art is, to ſhift the roots every year into freſh earth of different mixtures and to different ſituations, by which method I have had very good ſucceſs.

The earth of theſe beds ſhould be every year different; for although it is generally agreed that lean, hungry, freſh earth doth haſten their breaking, and cauſe their ſtripes to be the finer and more beautiful, yet, if they are every year planted in the like ſoil, it will not have ſo much effect upon them, as if they were one year planted in one ſort of earth, and the next year in a very different one; as I have ſeveral times experienced; and if ſome fine ſtriped tulips are planted in the ſame beds with the breeders, intermixing them together, it will alſo cauſe the breeders to break the ſooner.

The beſt compoſt for theſe roots is a third part of freſh earth from a good paſture, which ſhould have the ſward rotted with it, a third part of ſea-ſand, and the other part ſifted lime rubbiſh; theſe ſhould be all mixed together ſix or eight months at leaſt before it is uſed, and ſhould be frequently turned to mix the parts well together. With this mixture the beds ſhould be made about two feet deep, after the following manner: After the old earth is taken from out of the bed to the depth intended, then ſome of the freſh earth ſhould be put in about eighteen inches thick; this ſhould be levelled exactly, and then lines drawn each way of the bed chequerwiſe, at ſix inches diſtance; upon the center of each croſs, ſhould be placed the tulip roots, in an upright poſition; and after having finiſhed the bed in this manner, the earth muſt be filled in, ſo as to raiſe the bed ſix or eight inches higher, obſerving, in doing this, not to diſplace any of the roots, and alſo to lay the top of the beds a little rounding, to throw off the wet.

There are many perſons who are ſo careleſs in planting their tulip roots, as only to dig and level the beds well, and then with a blunt dibble to make holes, into which they put the roots, and then fill up the holes with a rake; but this is by no means a good method; for the dibble, in making the holes, preſſes the earth cloſely on each ſide, and at the bottom, whereby the moiſture is often detained ſo long about the roots as to rot them, eſpecially if the ſoil is inclinable to bind; beſides, the earth being hard at the bottom of the bulbs, they cannot ſo eaſily emit their fibres, which muſt certainly prejudice the roots.

Theſe beds ſhould be ſunk, more or leſs, below the ſurface, according to the moiſture or dryneſs of the ground; for the roots ſhould be ſo elevated as never to have the water ſtand near the reach of their fibres in winter, for moiſture is very apt to rot them; ſo that where the ſoil is very wet, it will be proper to lay ſome lime rubbiſh under the earth, in order to drain off the wet, and the beds ſhould be entirely raiſed above the level of the ground; but to prevent their falling down into the walks, after froſt, or hard rains, it will be proper to raiſe the paths between them, either with ſea-coal aſhes or rubbiſh, eight or ten inches, which will ſupport the earth of the beds; and theſe paths may ſlope at each end from the middle, which will make paſſage for the water to run off as it falls. But where the ſoil is dry, the beds may be ſunk eighteen or twenty inches below the ſurface, for in ſuch places the beds need not be more than four or ſix inches above the ſurface, which will be allowance enough for their ſettling.

During the winter ſeaſon there will be no farther care required. The roots being planted thus deep, will be in no danger of ſuffering by ordinary froſts; but if the winter ſhould prove very ſevere, ſome rotten tan or peaſe-haulm may be laid over the beds to keep out the froſt during its continuance, but this muſt be removed when the froſt is over; and in the ſpring, when their leaves begin to appear above ground, the earth upon the ſurface of the beds ſhould be ſtirred to clear it from weeds, moſs, &c. and when the flower-buds begin to come up, they ſhould be guarded from froſt, otherwiſe they are very ſubject to blight and decay ſoon after they appear, if the froſt pinches their tops; but they need only be covered in ſuch nights when there is a proſpect of froſt, for at all other times they ſhould have as much open air as poſſible, without which they will draw up weak, and produce very ſmall flowers.

When theſe breeders are in flower, you ſhould carefully examine them to ſee if any of them have broken into beautiful ſtripes, which, if you obſerve, there ſhould be a ſtick put into the ground by every ſuch root to mark them, that they may be ſeparated from the breeders, to plant amongſt the ſtriped flowers the following year; but you ſhould carefully obſerve, whether they have thrown off their former colour entirely, as alſo when they decay, to ſee if they continue beautiful to the laſt, and not appear ſmeared over with the original colour; in both which caſes they are very ſubject to go back to their old colour the next year: but if their ſtripes are diſtinct and clear to the bottom, and continue ſo to the laſt, which is what the floriſts call dyeing well, there is no great danger of their returning back again, as hath been by ſome confidently reported; for if one of theſe flowers is quite broken, as it is termed, it will never loſe its ſtripes, though ſometimes they will blow much fairer than at others, and the flowers of the off-ſets will be often more beautiful than thoſe of the old roots.

This alteration in the colour of theſe flowers may be ſeen long before they are blown, for the green leaves will appear of a fainter colour, and ſeem to be ſtriped with white, or of a browniſh colour, which is a plain proof, that the juices of the whole plant are altered, or, at leaſt, the veſſels through which the juice is ſtrained; ſo that hereby particles of a different figure are capable of paſſing through them, which, when entered into the petals of the flower, reflect the rays of light in a different manner, which occaſions the variety we ſee in the colours of flowers. This breaking of the colours in flowers proceeds from weakneſs, or at leaſt is the cauſe of weakneſs in plants; for it is obſervable, that after tulips are broken into fine ſtripes, they never grow ſo tall as before, nor are the ſtems, leaves, or flowers ſo large; and it is the ſame in all variegated plants and flowers whatever, which are alſo much tenderer than they were before they were ſtriped; ſo that many ſorts of exotic plants, which by accident have become variegated in their leaves, are often rendered ſo tender, as not to be preſerved without much more care, though indeed the ſtriping of tulips doth never occaſion ſo great weakneſs in them as to render them very tender. The greateſt effect it hath on them, is in leſſening their growth; the more beautifully their ſtripes appear, the ſhorter will be their ſtems, and the weaker their flowers.

There is nothing more to be obſerved in the culture of ſtriped flowers than what has been directed for breeders, excepting that theſe ſhould be arched over with tall hoops and rails, that they may be ſhaded from the ſun in the day-time, and protected from ſtrong winds, hard rains, and frofty mornings, otherwiſe the flowers will continue but a ſhort time in beauty; but where theſe inſtructions are duly followed, they may be preſerved in flower a full month, which is as long as moſt flowers continue.

There are ſome perſons who are ſo extremely fond of theſe flowers, as to be at a great expence in erecting large frames of iron work to cover their beds of tulips, in ſuch a manner, that they may walk between two beds under the frames, over which are ſpread tarpawlings, ſo as to keep off ſun, rain, and froſt, whereby they can view the flowers without being at the trouble of taking off or turning up the tarpawlings, or being incommoded by the ſun or rain, which cannot be avoided where the covering is low; beſides, by thus raiſing the covers, the flowers have a greater ſhare of air, ſo that they are not drawn ſo weak as they are when the covering is low and cloſe to them; but theſe frames being expenſive, can only be made by perſons of fortune; however, there may be ſome of wood contrived at a ſmaller expence, which, being arched over with hoops, may anſwer the purpoſe as well as the iron frames, though they are not ſo ſightly or laſting.

When the flowers are faded, the heads of all the fine ſorts ſhould be broken off, to prevent their ſeeding; for if this is not obſerved, they will not flower near ſo well the following year, nor will their ſtripes continue ſo perfect: this will alſo cauſe their ſtems to decay ſooner than otherwiſe they would do, ſo that their roots may be taken up in June; for they ſhould not remain in the ground after their leaves are decayed. In taking the roots out of the ground, you muſt be very careful not to bruiſe or cut them, which will endanger their rotting, and, if poſſible, it ſhould be done a day or two after rain. When theſe roots are taken out of the ground, they muſt be cleared from their old covers, and all ſorts of filth, and ſpread upon mats in a ſhady place to dry; after which they ſhould be put up in a dry place, where vermin cannot get to them, obſerving to keep every ſort ſeparated; but they ſhould not be kept too cloſe from the air, nor ſuffered to lie in heaps together, leſt they ſhould grow mouldy; for if any of the roots once take the mould, they commonly rot when they are planted again.

The offsets of theſe roots, which are not large enough to produce flowers the ſucceeding year, ſhould be alſo put by themſelves, keeping each ſort diſtinct: theſe ſhould be planted about a month earlier in autumn than the blowing roots, in particular beds by themſelves, in the flower-nurſery, where they may not be expoſed to public view; but the earth of the beds ſhould be prepared for them in the ſame manner as for larger roots; theſe ſhould not be planted above five inches deep, becauſe they are not ſtrong enough to puſh through ſo great covering of the earth as the old roots; they may alſo be placed much nearer together than thoſe which are to flower, and in one year moſt of them will become ſtrong enough to flower, when they may be removed into the flower-garden, and placed in the beds amongſt thoſe of the ſame kinds. *Miller's Gard. Dict.*

TULIP TREE, a very beautiful American tree, which produces flowers, ſuppoſed like thoſe of the tulip.

This tree, which is a native of North America, and where it grows to be a tree of the firſt magnitude, is generally known through all the Engliſh ſettlements by the title of poplar. Of late years there has been great numbers of theſe trees raiſed from ſeeds in the Engliſh gardens, ſo that now they are become common in the nurſeries about London, and there are many of the trees in ſeveral parts of England which do annually produce flowers. The firſt tree of this kind which flowered here, was in the gardens of the late earl of Peterborough at Parſons-Green near Fulham, which was planted in a wilderneſs among other trees. Before this was planted in the open air, the few plants which were then in the Engliſh gardens, were kept in pots or tubs, and houſed in winter, ſuppoſing they were too tender to live in the open air; but this tree, ſoon after it was planted in the full ground, convinced the gardeners of their miſtake, by the great progreſs it made, while thoſe which were kept in pots and tubs, increaſed ſlowly in their growth; ſo that afterwards there were many others planted in the full ground, which are now arrived to a large ſize, eſpecially thoſe which were planted in a moiſt ſoil. One of the handſomeſt trees of this kind near London, is in the garden of Waltham-Abbey; and at Wilton, the ſeat of the earl of Pembroke, there are ſome trees of great bulk; but the old tree at Parſons-Green is quite deſtroyed by the other trees which were ſuffered to over-hang it, and rob it of its nouriſhment, from a fear of taking down the neighbouring trees, and admitting the cold air to the tulip-tree, it ſhould injure it.

The young ſhoots of this tree are covered with a ſmooth purpliſh bark, garniſhed with large leaves, whoſe foot-ſtalks are long; they are ranged alternate; the leaves are of a ſingular form, being divided into three lobes; the middle lobe is blunt and hollowed at the point, appearing as if it had been cut with ſciſſars. The two ſide lobes are rounded, and end in blunt points. The upper ſurface is ſmooth, and of a lucid green; the under is of a pale green. The flowers are produced at the end of the branches; they are compoſed of ſix petals, three without and three within, which form a ſort of bell-ſhaped flower, from whence the inhabitants of North America gave it the name of Tulip. Theſe petals are marked with green, yellow and red ſpots, ſo make a fine appearance when the trees are well charged with flowers. The time of this tree's flowering is in July, and when the flowers drop, the germen ſwells

and forms a kind of cone; but theſe do not ripen in England.

This tree is propagated by ſeeds, which are now annually imported in great plenty from America. Theſe ſhould be ſown as ſoon as they arrive, in pots or tubs, filled with light earth, from the kitchen garden, or in a bed in the full ground. Thoſe which are ſown in the firſt way, may be placed on a very gentle hot bed, which will forward their growth; ſo that if they come up the ſame ſeaſon, the plants will acquire more ſtrength before winter. When the plants appear, they muſt be ſhaded in the heat of the day from the ſun, but freſh air muſt be admitted daily to prevent their drawing up weak; and as the ſeaſon advances, they muſt be gradually hardened to bear the open air. While the plants are young they do not care for much ſun, ſo they ſhould be either ſhaded, or placed where the morning ſun only ſhines upon them; they muſt alſo be conſtantly ſupplied with water, but not have it in too great plenty. As the young plants commonly continue growing late in the ſummer, ſo when there happens early froſts in autumn, it often kills their tender tops, which occaſions their dying down a conſiderable length in winter; therefore they ſhould be carefully guarded againſt theſe firſt froſts, which are always more hurtful to them than harder froſts afterwards, when their roots are better hardened; however, the firſt winter after the plants come up, it will be the better way to ſhelter them in a common hot-bed frame, or to arch them over with hoops, and cover them with mats, expoſing them always to the open air in mild weather.

The following ſpring, juſt before the plants begin to ſhoot, they ſhould be tranſplanted into nurſery beds, in a ſheltered ſituation, where they are not too much expoſed to the ſun. The ſoil of theſe beds ſhould be a ſoft gentle loam, not too ſtiff, nor over light; this ſhould be well wrought, and the clods well broken and made fine. There muſt be great care taken not to break the roots of the plants in taking them up, for they are very tender; then they ſhould be planted again as ſoon as poſſible, for if their roots are long out of the ground, they will be much injured thereby. Theſe may be planted in rows at about a foot diſtance, and at ſix inches diſtance in the rows; for as they ſhould not remain long in theſe nurſery-beds, ſo this will be room enough for them to grow; and by having them ſo cloſe, they may be ſhaded in the ſummer, or ſheltered in the winter, with more eaſe than when they are farther apart.

When the plants are thus planted, if the ſurface of the beds is covered with rotten tanners bark, or with moſs, it will prevent the earth from drying too faſt; ſo that the plants will not require to be ſo often watered, as they muſt be where they are expoſed to the ſun and air; after this, the farther care will be to keep them clean from weeds, and if the latter part of ſummer ſhould prove moiſt, it will occaſion the plants growing late in autumn, ſo their tops will be tender and liable to be killed by the firſt froſts. In this caſe they ſhould be covered with mats to protect them.

If the plants make great progreſs the firſt ſummer, they may be tranſplanted again the following ſpring; part of them may be planted in the places where they are to remain, and the other ſhould be planted in a nurſery where they may grow two years, to acquire ſtrength before they are planted out for good; though the younger they are planted in the places where they are to ſtand, the larger they will grow, for the roots run out into length; and when they are cut, it greatly retards their growth, ſo that theſe trees ſhould never be removed large; for they rarely ſucceed, if tranſplanted, when they are grown to a large ſize. Some indeed that have been removed pretty large, have ſurvived their removal; but young plants of two years old, which were planted near them, were much larger in fifteen years than the old ones.

When the ſeeds are ſown upon a bed in the full ground, the bed ſhould be arched over with hoops, and ſhaded in the heat of the day from the ſun, and frequently refreſhed with water; as ſhould alſo the plants when they appear, for when they are expoſed much to the ſun while young, they make but ſmall progreſs. The care of theſe in ſummer muſt be to keep them clean from weeds, ſupplying them duly with water, and ſhading them from the ſun in hot weather; but as theſe ſeeds will not come up ſo ſoon as thoſe which were placed on a hot-bed, they generally continue growing later in autumn, therefore will require ſhelter from the early froſts in autumn; for as the ſhoots of theſe will be much ſofter than thoſe of the plants which had longer time to grow, ſo if the autumnal froſts ſhould prove ſevere, they will be in danger of being killed down to the ſurface of the ground, by which the whole ſummer's growth will be loſt; and ſometimes the plants are entirely killed the firſt winter, if they are not protected.

As theſe plants will not have advanced ſo much in their growth as the other, they ſhould remain in the ſeed-bed to have another year's growth before they are removed; therefore all that will be neceſſary to obſerve the ſecond year, is to keep them clean from weeds; and now they will not be in ſo much danger of ſuffering from the warmth of the ſun as before, therefore will not require ſuch conſtant care to ſhade them, nor ſhould the watering of them be continued longer than the ſpring; for if the autumn ſhould prove dry, it will prevent the plants from ſhooting late, and harden thoſe ſhoots which were made early in the year, whereby the plants will be in leſs danger from the early froſts.

After the plants have grown two years in the ſeed-bed, they will be ſtrong enough to remove; therefore, in the ſpring, juſt at the time when their buds begin to ſwell, they ſhould be carefully taken up, and tranſplanted into nurſery-beds, and treated in the ſame way as has been before directed for the plants which were raiſed in pots.

There are ſome people who propagate this tree by layers, but the layers are commonly two or three years before they take root; and the plants ſo raiſed, ſeldom make ſuch ſtraight trees as thoſe raiſed from ſeeds, tho' indeed they will produce flowers ſooner, as is always the caſe with ſtinted plants.

This tree ſhould be planted on a light loamy ſoil, not too dry, on which it will thrive much better than upon a ſtrong clay, or a dry gravelly ground; for in America they are chiefly found upon a moiſt light ſoil, where they will grow to a prodigious ſize, though it will not be proper to plant theſe trees in a ſoil which is too moiſt, in England, becauſe it might endanger the rotting of the fibres of the roots, by the moiſture continuing too long about them, eſpecially if the bottom be a clay, or a ſtrong loam, which will detain the wet. *Miller's Gar. Dict.*

TUMBLER, a name given to a particular ſpecies of pigeon, called by Moore the columba revolvens.

It has its name from its peculiar property of tumbling, when it is in the air, which they are very fond of doing; and effect exactly in the ſame manner as our poſture-maſters do it, by throwing themſelves over backwards. It is a very ſmall pigeon, and is always ſhort-bodied, full-breaſted, thin-necked, narrow-beaked, and has a ſmall ſhort head; the iris of the eye, in this ſpecies, is uſually of a bright pearl-colour.

The Engliſh tumbler is uſually of one plain colour; black, blue, or white: the Dutch is much of the ſame make, but has different colours, and is feathered on the legs ſometimes; it has alſo a larger head, and thin ſkin round the eye. Some of the fineſt pigeons of this ſort are bred from a mixture of the Dutch and Engliſh kinds.

Theſe pigeons are remarkable for the height they fly to; they never ramble far from home, but will riſe almoſt perpendicularly, till they appear no larger than a ſparrow, or become quite out of ſight: they will often keep at this height five or ſix hours, and then come gradually down again: they will never tumble when they are at any great height, but only as they aſcend or come down again. There are particular times alſo, at which thoſe birds will take much higher flights than at others; but they ought to be kept by themſelves, and practiſed to it by the company of one of their own ſpecies; for if they mix, while young, with other pigeons, they will learn to fly as they do: a flight of a dozen of theſe birds ſent out together will keep ſo cloſe as to be all in a compaſs that might be covered with a handkerchief; but they ſhould never be turned out in foggy weather, or in high

high winds; in the firſt caſe they loſe ſight of their home, and perhaps never find it again, and, in the others, they are blown away; and, if they return, it is not till another day: in the mean time, lying out, they are in danger of cats, and other accidents.

Laſtly, the hen ſhould never be turned out with egg, for ſhe is then ſick, and not fit for flying; and, beſides, often drops her egg, and the breed is loſt by it. *Moore's Columbarium.*

TUMBLER, is alſo the name of a dog, ſo called from his quality of tumbling and winding his body about, before he attacks and faſtens on his prey.

Theſe dogs are often leſs than hounds; being lanker, leaner, and ſome-what pricked eared; and by the form of their bodies, they might be called mungrel greyhounds, if they were a little bigger.

TUMEFACTION, the act of ſwelling or riſing into a tumour.

Inflammations and tumefactions of the teſtes frequently happen in a gonorrhœa, either from the weakneſs of the veſſels, violent motion, unſeaſonable uſe of aſtringents, a neglect of purging, or the like.

TUMOR, or TUMOUR, in medicine and ſurgery, a preternatural riſing or eminence on any part of the body. Tumour is alſo defined, by phyſicians, a ſolution of continuity ariſing from ſome humour collected in a certain part of the body, which disjoins the continuous parts, inſinuates itſelf between them, and deſtroys their proper form.

Whether there be any ſuch preternatural riſing or enlargement on any part of the body, may be diſcovered from inſpection, but more particularly by feeling. And, notwithſtanding it is a general cuſtom to refer excreſcences, as warts, corns, and ſuch as grow in the noſe and pudenda, to the claſs of tumours; yet, becauſe they grow not from beneath, but out of, or upon, the ſkin itſelf, it is thought proper not to comprehend them in the general diviſion of tumours.

There are tumours of various kinds, diſtinguiſhed by particular names, according to the different cauſes from whence they proceed, and the particular parts wherein they are ſeated; ſome are called hot, others cold and watery; ſome are termed windy, others ſchirrhous; and ſome are named benign, others malignant: but Heiſter finds fault with theſe diſtinctions. There are ſome tumours which being contained in a proper membrane, are therefore called cyſtic: and if this ſhould be in an artery, it is uſually termed aneuriſm; but when in a vein, a varix. When in the veins of the anus, or rectum, the diſorder is termed hœmorrhoids; but if the tumour be in the ſcrotum, unguen, or at the umbilicus, it is generally called a hernia: if any pus, or matter, is contained in the tumour, it is called an abſceſs; and if the tumour is ſeated in a bone, it is termed exoſtoſis.

The forementioned claſs of tumours are all of them ſubdivided into ſeveral other kinds: thus the hot and burning tumours, which are the ſame with inflammations, are generally termed phlegmons, when violent and ſeated in the common integuments; but when ſlighter, they are commonly called furuncles. The inflammation which is not fixed deep, but ſpreads only ſuperficially upon the ſkin, is termed an eryſipelas: the inflammatory tumour that ariſes at the finger-ends is termed paronychia: that which fixes in the groin or armpits is called a bubo; and that under the ears a parotis. When an inflammation ſeizes the hands and feet from extreme cold, chilblains ariſe; which tumour is called pernio.

Encyſted TUMOURS, tumours ariſing in different parts of the body, but contained in certain membranous coats: theſe are ſometimes harder, ſometimes ſofter, of a paliſh colour, and uſually attended with little pain. Theſe tumours ariſe from obſtructions either in the glands, or in the adipoſe membrane, more eſpecially about the face and neck, where they occaſion great deformity. The membranous coat with which theſe tumours are inveſted, is often of a conſiderable thickneſs, and is uſually the coat of the diſordered gland, or ſome of the adipoſe cells. At their beginning they are uſually very ſmall and moveable; but encreaſing by ſlow degrees, they grow ſometimes to an enormous bulk.

The conſiſtence of ſome of theſe tumours is ſoft and fluctuating, and of others more hard and firm. They are of all ſhapes and ſizes, and ſome of them become hard as a callus, and unmoveable, while others are, for the generality, ſoft and moveable.

They are diſtinguiſhed according to the conſiſtence of their contents; ſome are called atheromata, from their contents reſembling paſte; others, which have them of the conſiſtence of honey, are called meliceres; but if they are of a fatty ſubſtance, like ſuet or lard, they are called ſteatomata. If they happen in a gland which becomes indurated, they are called ſchirrhous: and laſtly, when they are of a fleſhy conſiſtence, they are called ſarcomata. Some of theſe tumours have been found alſo full of hair.

They are diſtinguiſhed by others according to the places where they are ſituated.

Thoſe ſeated under the ſcalp are called talpa, teſtudo, or lupia; thoſe in the neck, ſtrumæ or ſcrophulæ; and thoſe in the hands and feet, eſpecially if among the tendons, are called ganglions.

There is no general method for the cure of them; but the ſurgeon, according to their different circumſtances, attempts this by diſcuſſion, ſuppuration, or extirpation.

But if the tumour can neither be diſperſed nor ſuppurated, but continues to enlarge itſelf, it is adviſeable to extirpate it in order to prevent its turning into a cancerous nature. There are ſeveral methods in practice for extirpating theſe tumours, according to their nature and ſize: thoſe which are ſmall and hard, or hung by a root as by a ſtalk, are generally beſt removed by ligature, in the manner of warts; by which means they wither and fall off of themſelves in a few days. But the moſt ready and expeditious method is to cut them off with a ſcalpel, and then heal up the wound: but if in removing them this way you divide a conſiderable artery, you may ſtop it by ſome potential, or even the actual, cautery; or elſe, by taking it up with a needle and thread. Laſtly, theſe tumours may be often removed by the application of cauſtic or corroding medicines, retained about the root by means of plaſters, compreſſes, and a bandage; and when you find the root of the tumour almoſt corroded through, the reſt may be divided by the ſcalpel.

If the root of the encyſted tumour appears too large for it to be conveniently taken off by ligature, you muſt then remove it either by the knife or by the cauſtics, though the latter is uſually preferred. In order to extirpate it by the knife, you muſt firſt make a longitudinal inciſion upon the tumour; and if that does not appear ſufficient, make another inciſion acroſs the former, till you think the wound large enough for taking out the tumour; in order to which you next dilate the integuments, and ſeparate them from the cyſt of the tumour, which you are to take out whole, if poſſible, either by means of the ſcalpel, a hook, or by paſſing a crooked needle, with a ſtrong thread, croſswiſe under the tumour; but great caution is neceſſary in this operation, leſt any important part that is contiguous to the tumour be injured.

The tumour being thus carefully extracted, if the wound and hæmorrhage be ſmall, you may preſs the lips together; and by covering the ſame with lint and compreſſes, retained with a proper bandage, the patient is cured in a few days time; but in caſe of a profuſe hæmorrhage, the blood is to be ſtopped either by ligature, aſtringents, or the actual or potential cautery.

Fungous TUMOURS. See FUNGUS.

Inflammatory TUMOURS. See the article INFLAMMATION.

Oedematous TUMOURS. See OEDEMA.

TUMOURS *of the parotid glands.* See the article PAROTIDES.

Peſtilential TUMOURS. See the articles BUBO and CARUNCLE.

Schirrhous TUMOURS. See SCHIRRHOUS.

TUMOURS *of the teſticles.* See TESTICLES.

TUN, or TON, originally ſignifies a large veſſel or caſk, of an oblong figure, biggeſt in the middle, and diminiſhing towards its two ends, girt about with hoops,

and uſed to put up ſeveral kinds of merchandize in for their better carriage, as brandy, oil, ſugar, ſkins, hats, &c.

Some derive the word from *autumnus*, in regard it is then tuns are moſt needed: Du Cange derives it from *tunna* or *tonna*, words uſed in the baſe Latin for the ſame thing, whence alſo *tunnare*, to tun.

The term is alſo uſed for certain veſſels of extraordinary bigneſs, ſerving to keep wine in for ſeveral years.—In Germany there are many which are ſcarce ever emptied: the Heidelberg tun is famous.

The tun, we frequently, though improperly, call a hogſhead.

TUN, or TON, is alſo a certain meaſure for liquids; as wine, oil, &c.

The Engliſh tun contains two pipes, or four hogſheads, or 252 gallons.

The tun of Amſterdam contains ſix aems or awms; and the aem four ankers, the anker two ſtekans, the ſtekan ſixteen mingles; twelve ſtekans are equal to an Engliſh barrel or ſixty-three gallons.

The tun of Bourdeaux and Bayonne contains four barrels, equal to three Paris muids.—At Orleans and Berry it is about two Paris muids.

The tun of Malaga, Alicant, Seville, &c. is two botta's, equal to about thirty-ſix or thirty-ſeven ſtekans.—The tun of Liſbon is two Portugueſe botta's, equal to twenty-five ſtekans.

Tun is alſo a certain weight whereby the burthens of ſhips, &c. are eſtimated.—The ſea-tun is computed to weigh forty hundred weight.

TUNE, or TONE, in muſic, that property of ſounds whereby they come under the relation of acute and grave to one another.

Though gravity and acuteneſs are mere terms of relation, the tune of the ſound is ſomething abſolute, every ſound having its own proper tone, which muſt be under ſome determinate meaſure in the nature of the thing.

The only difference then, between one tune and another is in the degrees.

If two or more ſounds be compared together in this relation, they are either equal or unequal in the degree of tune.—Such as are equal are called uniſons.

The unequal conſtitute what we call an interval, which is the difference of time between two ſounds.

Sonorous bodies we find differ in tune: 1. According to the different kinds of matter; thus a wedge of ſilver ſounds much more acute than a wedge of gold of the ſame ſhape and dimenſions, in which caſe the tones are proportional to the ſpecific gravity. 2. According to the different quantities of the ſame matter in bodies of the ſame figure, a ſolid ſphere of braſs, one foot diameter, ſounds acuter than one of two feet diameter; in which caſe the tunes are proportional to the quantity of matter. Here then are different tunes connected with different ſpecific gravities and quantities of matter, as their immediate cauſe. In effect, the meaſures of tune are only ſought in the relations of the motions that are the cauſe of ſound, which are no way ſo diſcernible as in vibrations of chords.

In the general we find that, in two chords, all things being equal, except tenſion, or thickneſs, or length, the tunes are different; there muſt, therefore, be a difference in the vibrations owing to theſe different tenſions, &c. which difference can only be in the velocity of the courſes and recourſes of the chords, through the ſpaces wherein they move to and again. Now, upon examining the proportion of the velocity and the things juſt mentioned, wherein it depends, it is found, to a demonſtration, that all the vibrations of the ſame chord are performed in equal times. Hence, as the tone of a ſound depends on the nature of thoſe vibrations, whoſe difference we can conceive no otherwiſe than as having different velocities; and as the ſmall vibrations of the ſame chord are performed in equal times, and it is found true, in fact, that the ſound of any body, ariſing from any individual ſtroke, though it grow gradually weaker, yet continues the ſame tone from firſt to laſt: it follows, that the tone is neceſſarily connected with a certain quantity of time, in making every ſingle vibration; or, that a certain number of vibrations, accompliſhed in a given time, conſtitutes a certain determinate tune; for the more frequent thoſe vibrations are, the more acute the tone; and, the ſlower and fewer they are, the more grave the ſound, though performed in the ſame ſpace of time; ſo that any given note of a tune is made by one certain meaſure of velocity of vibrations, i. e. ſuch certain courſes and recourſes of a chord or ſtring, in ſuch a certain ſpace of time, conſtitute a determinate tune.

This theory is ſtrongly ſupported by our beſt and lateſt writers on muſic, Dr. Holder, Mr. Malcolm, &c. both from reaſon and experience. Dr. Wallis, who holds it very reaſonable, adds, that it is evident the degrees of acuteneſs are reciprocally as the lengths of the chords, though, he ſays, he will not poſitively affirm that the degrees of acuteneſs anſwer the number of vibrations as their true cauſe: but this difference ariſes hence, that he doubts whether the thing has been ſufficiently proved by experiment. Indeed, whether the different number of vibrations, in a given time, is the true cauſe on the part of the object of our perceiving a difference of tune, is a thing which, we conceive, does not come within the reach of experiment. It is enough that the hypotheſis is reaſonable.

TUNICA, a kind of waiſtcoat, or under-garment, in uſe amongſt the Romans. They wore it within doors by itſelf, and abroad under the gown. The common people could not afford the toga, and ſo went in their tunics, whence Horace calls them popellus tunicatus. The ſeveral ſorts of the tunic were the palmata, the anguſticlavia, and the laticlavia. The firſt was worn by generals in a triumph, and perhaps always under the toga picta; it had its name either from the great breadth of the clavi, equal to the palm of the hand; or elſe from the figures of palms, embroidered on it. For the other two, ſee the article CLAVUS.

It was by theſe three different ſorts of tunicks, that the three different orders of the Roman people were diſtinguiſhed in habit.

TUNICA, *Tunic*, in anatomy, is applied to the membranes which inveſt the veſſels, and divers others of the leſs ſolid parts of the body; thus the inteſtines are formed of five tunics, or coats, for which ſee the article INTESTINES.

There are alſo five tunics, or coats, of the eye, for which ſee the article EYE.

TUNIS, a kingdom of Barbary, in Africa, once the famous republic of Carthage, but now circumſcribed within narrow bounds, having Tripoli on the eaſt, the river Gualdibarbar, which parts it from Conſtantina, on the weſt, Biledulgerid Proper on the ſouth, and the Mediterranean ſea on the north. Its extent from eaſt to weſt along the coaſt is 200 miles; but is of unequal breadth.

The preſent Tuneſe are not the deſcendants of the ancient Carthaginians, but a mixture of Goths, Vandals, Moors, Arabs, and Turks, with renegadoes of all nations, being no other than a neſt of deſperate banditti and pirates.

The ſoil and climate are much the ſame with thoſe of Tripoli, as is alſo its government. The dey is abſolute; but being elected by the Turkiſh ſoldiers, is as liable to be depoſed, and even murdered, as the dey of Algiers, who ſeldom has a long reign.

The chief employment of the inhabitants, is piracy: the Europeans, however, traffic with them in ſome oil, olives, dates, ſope, kali, or aſhes, oſtrich-feathers, camels, and horſes. The Jews are very numerous here, and in the coaſt-towns of Barbary, as their brokers. Notwithſtanding the infamous original of the Tuneſe, they value themſelves upon their nobility; and they uſe the Moors and other inhabitants of Africa like ſlaves.

TUNNAGE is uſed for a cuſtom or impoſt, payable to the crown, for goods and merchandize imported or exported, and is to be paid after a certain rate for every tun thereof. This duty, as well as that of poundage,

was firſt granted for life to king Charles II. and has been continued in the ſame manner to his royal ſucceſſors, down to his preſent majeſty king George III.

TUNNEL-NET, a net for taking partridges, which ſhould not exceed fifteen feet in length, nor be leſs than eighteen inches in breadth, or opening for the entrance.

When you have found a covey, fetch a compaſs and pitch the net at a good diſtance from them, ſometimes farther, at other times nearer, according to the ſituation of the ground; ſurround them either with a natural or artificial ſtalking-horſe, and gently drive them towards the net, not coming on them in a direct line, but by turnings and windings, and ſometimes ſtanding ſtill, as if the horſe grazed. In caſe they make a ſtand and look up, it is a ſign of fear, and that they intend to take wing; ſtand ſtill therefore, or retreat for a while; and when you find them quiet after a little reſpite, and buſy in ſeeking after meat, you are to move nearer, and if any ſingle partridge lies remote from the reſt, he may be brought in by fetching a compaſs about him. The wing of the tunnel muſt not be pitched in a direct line, but inclining to a ſemi-circle.

TUNNING *of Ale or Beer*, a part of the proceſs of brewing, or rather an operation which is the ſequel thereof. When the beer has worked or fermented in an open vat, as long as is proper, tun it up into ſeaſoned veſſels, that is, ſuch as have had ale or beer in them before; for if it be put into new caſks, it muſt be made ſtronger than ordinary, elſe it will not keep ſo long, becauſe the caſk will imbibe the ſpirits, and the reſt will ſoon become flat and vapid. It is beſt to tun beer juſt when it comes to a due fermentation, and gets a good head; for then it has the moſt ſtrength to clear itſelf in the caſk, and what works over may be put into the ſmall beer, and muſt be ſupplied with freſh beer of the ſame brewing. When the beer is tunned, carry it while it works in the caſk, into a good cellar, or proper place to preſerve it; for if it be ſtirred after it has done working, it will be apt to grow ſtale, ſour, and become alegar, unleſs it be drawn out into another caſk.

TUNNY, a name given by us to the Spaniſh mackarel, a larger fiſh of the ſcomber kind, called by authors thynnus and arcynus, by Salvian limoſa, and pelamys by Ariſtotle, Ælian, and the other old writers.

It is properly a ſpecies of the ſcomber, and is expreſſively named by Artedi the ſcomber with eight or nine fins in the hinder part of the back, riſing out of a furrow; and a furrow at the place of the belly-fins.

TURBAN, or TURBANT, the head-dreſs of moſt of the Eaſtern nations. It conſiſts of two parts, a cap, and a ſaſh of fine linen, or taffety, artfully wound in divers plaits about the cap. The Turks call the ſaſh turbent, whence we have formed turban. The cap has no brim, is pretty flat, though roundiſh at top, and quilted with cotton, but does not cover the ears. There is a good deal of art in giving the turban a fine air, and the making of them is a particular trade. The ſaſh of the Turks turban is white linen; that of the Perſians red woollen. Theſe are the diſtinguiſhing marks of their different religions. Sophi, king of Perſia, being of the ſect of Ali, was the firſt who aſſumed the laſt colour, to diſtinguiſh himſelf from the Turks, who are of the ſect of Omar, and whom the Perſians eſteem heretics. The Emirs, who pretend to be deſcended of the race of Mahomet, wear their turbans quite green, which was the colour wore by that falſe prophet. The grand ſeignior's turban is as big as a buſhel, and ſo exceedingly reſpected by the Turks, that they ſcarce dare touch it. It is adorned with three plumes of feathers, enriched with diamonds and precious ſtones, and he has an officer on purpoſe to look after it. The grand vizier's turban has two plumes; ſo have thoſe of divers other officers, only ſmaller one than another; others have only one, and others none at all. The turban of the officers of the divan is of a peculiar form.

TURBAN-SHELL, *cidaris*, in natural hiſtory, the name of a genus of the echinodermata, which are of the hemiſpheric or ſpheroidal figure, and have their name from the Latin, *cidaris*, a Perſian turban, as in ſome degree reſembling that head-dreſs.

TURBARY, denotes a right to dig turfs on another's ground; and it is likewiſe taken for the ground or place where turfs are digged, ſometimes called the turfary.

TURBINATED, is a term applied by naturaliſts, to ſhells which are ſpiral, or wreathed, conically, from a larger baſis to a kind of apex.

TURBINITÆ, foſſil ſhells of the turbo kind, or ſtones found in thoſe ſhells. Among the people who have objected to the ſhells found buried in the earth being the remains of real animals, it has been alledged by ſome, that theſe, in particular, are always of a blackiſh or aſh-colour, when found in chalk of clay, and white from the rocks, or when they have been bedded in ſtone.

TURBIT *Pigeon*, a particular ſpecies of pigeon remarkable for its ſhort bill, and called by the Dutch cort-bek, that is, ſhort-beak. Moore calls it, in Latin, *columba fimbricata*: and its Engliſh name ſeems no other than a bad pronunciation of its Dutch one. It is a ſmall and ſhort-bodied pigeon, and has a beak no longer than that of a partridge; the ſhorter this is, the more the pigeon is eſteemed: it has a ſhort round head, and the feathers upon the breaſt open and reflect both ways, ſtanding out like the frill of the boſom of a ſhirt. This is called by many the purle, and, the more the bird has it, the more it is eſteemed. The tail and back are generally of one colour, as blue, black, red, yellow, or dun, and ſometimes chequered. The flight feathers, and thoſe of all the reſt of the body, are white. They are a light nimble pigeon, and, if trained to it, will take very high flights in the manner of the tumblers. *Moore's Columbarium.*

TURBITH ROOT, is the root of a large convolvulus, growing in moiſt places near the ſea-coaſts, in the iſland of Ceylon, Surat, Malabar, Goa, but moſt plentifully in Guzarotta, from whence the greateſt quantities of the roots are brought into Europe. The root is commonly about the thickneſs of the finger, though ſometimes twice or thrice as thick, browniſh on the outſide, whitiſh within, with a white ſpongy woody pith: its taſte is at firſt ſweetiſh, afterwards acid and diſagreeable.

The Indians formerly ſlit the roots longitudinally, and took out the woody matter. At preſent the roots are generally brought over pith and all, being only cut tranſverſely into oblong pieces, which are often found to be ſcorched at the ends: the uſe of the ſcorching is to ſear up the divided veſſels, and prevent the oozing out of the reſinous yellowiſh juice, with which the freſh roots abound. Albinus's ſuſpicion, that this juice is deſignedly extracted from them, before they come to us, appears to be groundleſs.

Turbith-root is a moderately ſtrong purgative: as ſuch the root in ſubſtance was formerly given, from a ſcruple to half a dram, and the reſin to half a ſcruple; but ſince the introduction of jalap, turbith has been rarely uſed.

TURBITH-MINERAL, yellow precipitate of mercury. See MERCURY.

TURBO, in natural hiſtory, a genus of univalve ſhells, with a long, wide, and depreſſed mouth, in ſome ſpecies approaching to a round ſhape, and in ſome having teeth, in others not. They all grow narrow towards the baſe, and are auriculated, and terminate in a very long and ſharp point.

Of this genus, there are a great many elegant ſpecies; as the ſlender turbo, with ventricoſe ſpires, and a ſmall round mouth, about five or ſix inches long; beſides which, there are numerous other ſpecies, as the caterpillar-ſhell, teleſcope-ſhell, &c. all diſtinguiſhed by their different ſpires, and the form of their mouths.

TURBOT, or TURBUT, in ichthyology, the Engliſh name of a ſpecies of pleuronectes, with the eyes on the right ſide, and the body ſmooth.

It grows to a conſiderable ſize, and is one of the moſt eſteemed fiſh at table.

TURCICA-TERRA, TURKY-EARTH, a very fine bole or medicinal earth, dug in great plenty in the neighbourhood of Adrianople, and uſed by the Turks as a ſudorific and aſtringent; and famous among them in peſtilential diſeaſes. It is ſometimes brought over to us

alſo made up into flattiſh, orbicular maſſes of two or three drams weight, and ſealed with ſome Turkiſh characters. This earth is of a ſomewhat lax and friable texture, yet conſiderably heavy, of a greyiſh, red colour, but always redder on the ſurface than within; extremely ſoft, and naturally of a ſmooth ſurface: it melts freely in the mouth, with a conſiderably ſtrong, aſtringent taſte. See the article BOLES.

TURCOISE, or TURQUOISE, *Turcheſia*, in natural hiſtory, an ore of copper, erroneouſly ranked among gems.

There are, indeed, two kinds of turcois; the one a true and genuine ore of copper: the other the bones of animals tinged to a beautiful blue colour, by having been buried in places where copper-ore has been near them.

That kind which we uſually diſtinguiſh by the name of the turquoiſe of the old rock, and which Pliny and the antients called callais, is a true and genuine copper-ore, and is of exactly that kind in regard to this metal, that the hæmatites is to iron; it is found in the perpendicular fiſſures of the ſtrata of ſtone, which contain copper adhering to their ſides in form of a cruſt, and riſing into botryoide efflorescences, which ſometimes ſtand ſingle, and are in bigneſs from the ſize of a pea to that of a walnut; but ſometimes happening to be placed cloſe to one another, they join and form flat cruſts or maſſes, extending, in the manner of cruſts of the hæmatites, to three, four, or more inches in breadth; in theſe the prominent part of every tubercle appearing on the ſurface, the whole ſeems a conjunction of ſemi-circular bodies of a fine blue colour joined by an intermediate ſubſtance of the ſame nature.

This kind of the turquoiſe is of a very cloſe texture and gloſſy ſurface but very ſoft, and, when broken, ſhews the ſame cruſtated and ſtriated texture with the hæmatites; only that the ſtriæ are uſually finer, and the plates better joined. It ferments with aqua fortis, and may be in great part diſſolved by it; and on calcining, it loſes all its colour, and becomes of a dirty white. This is produced in Perſia, and ſome other parts of the Eaſt. The Germans alſo have a botryoide copper-ore, in ſome of their mines; but it is green, and much ſofter than the true turquoiſe of this kind, though this has been often produced among us alſo under the name of that gem.

The other turquoiſe is nothing more than the teeth or bones of animals, which have lain in the way of effluvia, in which copper has been contained, and by this means have acquired veins and ſtreaks of a deep blue, which, on the whole being ſlightly calcined, diffuſe themſelves through all the ſubſtance, and give it the fine pale blue we ſo much admire in this gem. If the fire that diffuſes this colour be a little too ſtrong, it ſends it wholly off, and leaves in place of the turquoiſe only a white bone. The turquoiſes of this laſt kind are common in France; there are mines of them there, and the people who work them are perfectly acquainted with the method of diffuſing the colour through them. Theſe are what are now uſually worn, and, when fine, are called, by many of our jewellers, turquoiſes of the old rock, as well as the other. The virtues attributed to this gem are very great, but all we know of it at preſent is, that, like the other bodies that contain copper, it is a violent emetic, and not fit to be received into practice.

Compoſition of hard Glaſs, or Paſte, reſembling the TURQUOISE *Stone.*

"Take of the compoſitions for blue glaſs, or paſte N°. 7 or 8, being thoſe reſembling the eagle marine, ten pounds; of calcined bone, horn, or ivory, half a pound. Powder and mix them well; and then fuſe them in a moderate heat, till they be thoroughly incorporated."

TURDUS, in ornithology, a genus of birds, the beak of which is of a conic form, and ſtraight, only ſomewhat bent on the upper part, and has no membrane at the baſe: the tongue is lacerated and emarginated.

Under this genus are comprehended the black-bird, thruſh, red-wing, &c.

TURDUS, in ichthyology, the name by which authors call the green labrus, with a blue line on each ſide; a very beautiful fiſh, from eight to fourteen inches in length, and conſiderably thick in proportion.

TURF, a blackiſh, ſulphureous earth, uſed in ſeveral parts of England, Holland, and Flanders, as fewel.

In Flanders, their turf is dry or pared from off the ſurface of the earth, and cut in form of bricks.—The ſedge, or ſpecies of graſs growing very thick on the turf earth, contributes greatly, when dry, to the maintenance of the fire.

The Dutch take their turf from the bottom of the dykes or canals which run acroſs moſt of their lands; by which means they not only ſupply the defect of wood, which is very great in moſt of the United Provinces, but alſo keep their dykes clear and navigable: this turf earth is very black. As they take it up from the bottom of the dykes, they ſpread it about the edges, of ſuch a thickneſs, as that it may be reduced to three inches when moderately dried.—In this condition they cut it into pieces of turfs ſeven or eight inches long, and three broad, and, to complete the drying, lay them up in heaps, and at laſt in ſtacks.

In the north of England, Scotland, &c. turf is dug out of ſoft, moiſt, rotten earth, called peatmoſs.—They dig horizontally from the ſurface, to the depth of about four foot, with a ſpade, which at once faſhions and takes them out in parallelopipeds nine or ten inches long, and three ſquare; which are ſpread on the ground to drain as faſt as dug; and then ſet up an end three or four againſt each other, for the wind to blow through them; and at laſt they are ſtacked or houſed.—The pits or dykes in a few years fill up again, and afford a freſh crop.

TURFING-SPADE, among huſbandmen, is an inſtrument uſed to under cut the turf, after it is marked out with a trenching-plough.

TURGESCENCE, TURGESCENCY, a ſwelling, or growing bloated.

TURIONES, among herbaliſts, denotes the firſt young tender ſhoots, which plants annually put forth.

TURKEY, *Meleagris*, in ornithology, a genus of birds, the anterior part of the head of which is covered with a fleſhy pendulous ſubſtance; the ſides of the head alſo, and the throat, are covered with a papillous fleſhy matter, and there is a longitudinal fleſhy creſt, of a reddiſh, bluiſh, or purpliſh colour, and a ſoft ſubſtance. This is a large, but unwieldy bird; the head is ſtrangely covered and ornamented with a pendulous, ſoft, fleſhy, ſubſtance, as already obſerved; the eyes are ſmall, but bright and piercing; the wings are moderately long, though not at all formed for ſupporting ſo large a bulk in long flights; they have each twenty-eight long feathers; the tail is long and large, the legs moderately long, and very robuſt. There is but one known ſpecies of this genus.

TURKY, a conſiderable modern empire, containing ſeveral rich and extenſive countries. In Europe the Turks poſſeſs Romania, Bulgaria, Beſſarabia, Budziack, Moldavia, Walachia, Servia, a part of Sclavonia and Hungary, Croatia, Boſnia, Dalmatia, Raguſa, ancient Greece, and in general the numerous iſlands on its coaſt, or thoſe of the Archipelago, with Ockzakow Tartary, Tartary the Leſs, and Crim-Tartary; which three laſt countries are tributaries or allies to the Ottoman Porte.

In Aſia they are maſters of Anatolia, or Aſia Minor, the iſlands on its coaſts or in the Levant, Syria, Phœnicia, Paleſtine or Judea, Arabia, Diarbecker or Meſopotamia, Yerack or Chaldea, Curdiſtan or Aſſyria, Armenia Major, now Turcomania, part of Georgia, Mingrelia, and Circaſſia. Laſtly, in Africa they are poſſeſſed of Egypt, beſides innumerable tributaries in that part of the world; yet all theſe conſiderable advantages are loſt to the Turks, through their natural indolence; for they are above applying to trade or manufactures, theſe they leave to deſpiſed Chriſtians. The merchandize of other countries are carried to them in foreign bottoms, as are alſo their own produce and manufactures: ſo that the only

only advantage which they reap is from the duties of export and import.

The number of Chriſtians exceeds that of Mahometans, eſpecially in European Turky, where they are allowed the free exerciſe of their religion, in reward of their labour and induſtry, which indeed are the main ſupport of this empire; and they are never forced into the Turkiſh armies, but left to follow their employments, whilſt the Turkiſh gentry take the defence of their country, and the buſineſs of foreign conqueſts entirely upon themſelves.

The goods chiefly exported from Turkey are raw ſilk, carpets, goats-hair, wool, mohair, cotton, woollen yarn, dimities, chagrins, cordouans, coffee, turpentine, terra lemnia, rhubarb, gum arabic, opium, cochinchina, and other drugs; with wine, oil, figs, raiſins, currants, dates, &c.

The Ottoman emperor or grand ſignior is abſolute, and the throne hereditary down from the grand impoſtor Mahomet: for though his guards the Janizaries often depoſe him as they pleaſe, yet they prefer the neareſt relation to the imperial dignity. The emperor indeed has an abſolute authority over the inhabitants of the ſeraglio, his baſhaws, and officers, as well as over his Chriſtian ſubjects; yet the Turkiſh gentry, who have no places at court, nor dependence on the ſovereign, enjoy their liberties and properties, paying no taxes, the attempt to impoſe which, or the leaſt innovation in their cuſtoms, would endanger the depoſing of the emperor.

His baſhaws, governors, and officers of ſtate, with the inhabitants of the ſeraglio, and even the Janizaries, are children of Chriſtian parents, either taken in war or purchaſed from Georgia or Circaſſia, who from their infancy are trained up in the military diſcipline, and the Mahometan religion.

The Turkiſh militia is very numerous; but the flower of all and their chief dependence are the Janizaries, of which 25000 are always in pay. Other troops bear this name; but they are not enrolled with the former, and may amount to about 100,000 in the whole Ottoman empire. The ſedar or commanding officer of the Janizaries in every province takes money of the Turks for being entered into this body; ſo that by this means each of them purchaſes the privilege of committing any outrages with impunity, and being ſcreened from juſtice, ſince a Janizary is accountable to none but his officers for any violences which he may commit. The general of this militia is called aga of the Janizaries, and is always choſen out of the royal chamber of the ſeraglio; becauſe, as it is an office of great importance, it is thought neceſſary to be entruſted to one whoſe education and preferment have made him a creature of the court.

The Turkiſh cavalry or ſpahis, being trained up in warlike exerciſes like the infantry or Janizaries, compoſe a formidable body; beſides theſe, there are great bodies of forces in every province, which conſtitute their numerous armies; but their numbers have often occaſioned their defeat, as they charge in too great confuſion. The renegado baſhaw Count Bonneval, however, having introduced the French diſcipline among them, they made a good advantage of this in the recovery of the vaſt extent of country ſouth of the Danube.

The Turks, though their dominions lie on ſeveral ſeas, with many commodious harbours, are but weak in maritime forces, chiefly owing to their neglect of navigation and foreign commerce: ſo that they are in great want of good mariners, ſkilful pilots, and experienced officers; thoſe belonging to the grand ſignior ſcarcely knowing how to uſe the compaſs.

The revenues of the grand ſignior are partly fixed, and partly caſual. The fixed are thoſe which ariſe from the cuſtoms, or poll-tax impoſed on the Jews and Chriſtians, the exciſe on all the produce of the ſoil, and the annual ſums from the tributaries, beſides five millions returned from Egypt.

The caſual revenues conſiſt in inheritances, the prince being heir to the great and ſmall to whom he gave penſions; and alſo to the ſoldiers, when they die without children: if only daughters are left, he receives two thirds of the eſtate. The ſpoils of the great men of the Porte and the baſhaws riſe to an immenſe ſum: very often the grand ſignior does not ſtay for their dying a natural death, or give them time to conceal their treaſure; but their gold, ſilver, jewels, and heads, are at once carried to the ſeraglio; beſides, ſuch as the ſultan gratifies with any poſt of conſequence, are indiſpenſably obliged to make him preſents.

The eſtabliſhed religion throughout Turky is Mahometiſm, but Chriſtians and Jews are tolerated among them.

TURLUPINS, in church hiſtory, an infamous ſect, which made its appearance in France in the fourteenth century, and the reign of Charles V. Their principal ſcene was in Savoy and Dauphiny.

They taught, that, when a man is arrived at a certain ſtate of perfection, he is freed from all ſubjection to the divine law. They allowed of no prayer to God, but mental. They often went naked, and ſaid, we ought not to be aſhamed of any parts which nature has given us. Notwithſtanding theſe impious extravagances, they affected great airs of ſpirituality and devotion, the better to inſinuate themſelves into the good opinion of the women. It is not eaſy to find the true reaſon of their name. Vignier thinks, they were called Turlupins, becauſe they uſually abode in places expoſed to wolves, *lupis*. They affected to call themſelves "The fraternity of the poor."

The Turlupins were proſecuted by order of the government. Their books and cloaths were burnt at Paris; and Joan Dabentonne, and another woman, who were the principal preachers of this ſect, were burnt alive.

TURMERIC, a ſmall tuberous knotty root, brought from the Eaſt Indies; externally greyiſh, internally of a deep lively yellow or ſaffron colour, which by age changes more and more towards a red. Two ſorts are mentioned by authors, one longiſh, the other roundiſh: only the firſt is met with in the ſhops.—Turmeric has a ſlight, aromatic, and not very agreeable ſmell; and a bitteriſh ſomewhat warm taſte. It readily gives out its active matter both to aqueous and ſpirituous menſtrua: to the former it communicates its own deep yellow, to the latter a fine yellowiſh red tincture. In diſtillation with water, it yields a ſmall quantity of a gold coloured eſſential oil, of a moderately ſtrong ſmell and a pungent taſte: the remaining decoction, inſpiſſated, leaves a bitteriſh, conſiderably ſaline maſs. Rectified ſpirit elevates little or nothing of its virtues; all the active parts of the root being left behind in the inſpiſſated extract, which is moderately warm, and bitter, and not a little nauſeous.

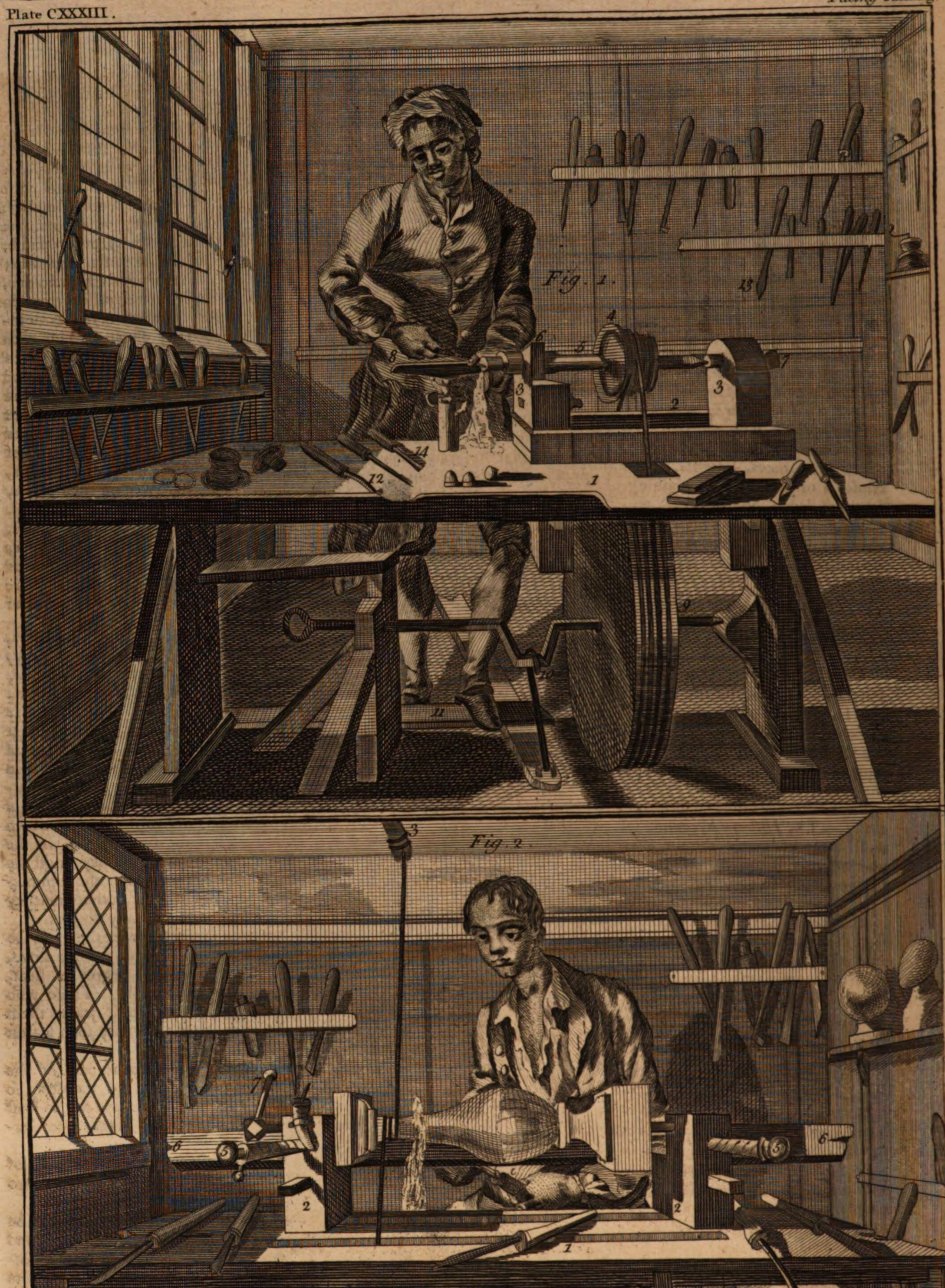
This root is ſaid to be in general uſe in the Eaſtern countries, both for the colouring and ſeaſoning of food, and as a medicine: it is accounted one of the moſt effectual remedies in obſtructions of the viſcera and meſentery, which are there frequent; in uterine diſorders, difficulties of urine, and affections of the kidneys. Among us it has been employed alſo as a deobſtruent, and eſteemed by ſome a ſpecific in the jaundice: the doſe in ſubſtance is from a ſcruple to a dram; in decoction or infuſion, twice as much. It tinges the urine of a deep yellow colour.

The ſpirituous tincture of turmeric applied upon warm marble, gives a durable red ſtain. Woollen cloth, impregnated with a ſolution of alum and tartar, acquires on being boiled with the watery decoction, an elegant, but not very durable orange yellow or gold coloured dye. It is rarely made uſe of by the dyers on account of its price and the periſhableneſs of its colour.

TURN, in law, a court held twice a year, viz. within a month after Eaſter and Michaelmas, reſpectively, by the ſheriff of every county.

By magna charta, ſheriffs were reſtrained from holding pleas of the crown; but they are ſtill judges of record, and may take indictments and preſentments, and inquire of all treaſons and felonies by the common law, as well as the loweſt offences againſt the king; common nuſances, annoyances, purpreſtures, &c. Alſo of perſons ſelling corrupt victuals, breaking the aſſiſe of ale and beer,

Plate CXXXIII.



beer, or keeping falſe weights, &c. diſturbers of the peace and barretors, &c. and may amerce for offences, &c.

TURNADO, or TORNADO, a wind which on ſome coaſts blows all night from the ſhore.

TURNAMENT, or TOURNAMENT, a martial ſport, or exerciſe, which the antient cavaliers uſed to perform to ſhew their bravery and addreſs.

The firſt turnaments were only courſes on horſeback, wherein the cavaliers tilted at each other with canes, in manner of lances; and were diſtinguiſhed from juſts, which were courſes or careers, accompanied with attacks and combats with blunted lances and ſwords.

Others ſay, it was a turnament when there was only one quadril or troop; and that where there were ſeveral to encounter each other, it was a juſt.—But it is certain the two became confounded together in proceſs of time; at leaſt we find them ſo in authors.

The prince who publiſhed the turnament, uſed to ſend a king at arms with a ſafe-conduct, and a ſword to all the princes, knights, &c. ſignifying, that he intended a turnament and a claſhing of ſwords, in the preſence of ladies and damſels: which was the uſual formula of invitation.

They firſt engaged man againſt man, then troop againſt troop; and after the combat the judges allotted the prize to the beſt cavalier, and the beſt ſtriker of ſwords; who was, accordingly, conducted in pomp to the lady of the turnament; where, after thanking her very reverently, he ſaluted her, and likewiſe her two attendants.

Theſe turnaments made the principal diverſion of the thirteenth and fourteenth centuries. Munſter ſays, it was Henry the Fowler, duke of Saxony, and afterwards emperor, that firſt introduced them; but it appears from the chronicle of Tours, that the true inventor of this famous ſport, was one Geoffry, lord of Preuilli, about the year 1066.

From France they paſſed into England and Germany.—The *Hiſtoria Byzantina* tells us, that the Greeks and Latins borrowed the uſe thereof from the Franks; and we find mention made of them in Cantacuzenus, Gregorias, Beſſarion, and others of the late Greek authors.

Budæus derives the word from *Trojana agmina*; others from *Trojamentum*, *quaſi ludus Trojæ*. Menage deduces it from the Latin, *tornenſis*, or the French, *tourner*, in regard the combatants turned and twiſted this way and that. M. Paris calls them in Latin, *haſtiludia*; Neubrigenſis, *meditationes militares*; others *gladiaturæ*, others *decurſiones ludicræ*, &c.

Pope Eugenius II. excommunicated thoſe who went to turnaments, and forbad them burial in holy ground.—King Henry II. of France died of a wound received at a turnament.—One Chiaoux, who had aſſiſted at a turnament under Charles VIII. ſaid very wiſely, "If it be in earneſt, it is too little; if in jeſt, too much."

It is to the exerciſe of turnaments that we owe the firſt uſe of armories: of which the name blazonry, the form of the eſcutcheons, the colours, principal figures, the mantlings, label, ſupporters, &c. are undeniable evidences.

In Germany, it was anciently a cuſtom to hold a ſolemn turnament every three years, to ſerve as a proof of nobility. For the gentleman who had aſſiſted at two, was ſufficiently blazoned and publiſhed; that is, he was acknowledged noble, and bore two trumpets by way of creſt on his turnament caſque.—Thoſe who had not been in any turnaments, had no arms, though they were gentlemen.

TURNERA, in botany, a genus of plants; the empalement of the flower is funnel-ſhaped, having an oblong, cylindrical, angular tube, cut into five ſegments. The flower has five heart-ſhaped plain petals, with narrow tails, which are inſerted in the tube of the empalement; it has five awl-ſhaped ſtamina, which are ſhorter than the petals, inſerted in the empalement, terminated by acute pointed erect ſummits, and a conical germen, ſupporting three ſlender ſtyles, crowned by many hairy pointed ſtigmas. The germen afterward turns to an oval capſule with one cell, which opens at the top with three valves, and contains ſeveral oblong obtuſe ſeeds.

There are two ſpecies of this plant, and both natives of America. The firſt ſort of which riſes with a ſhrubby ſtalk to the height of eight or ten feet, ſending out branches on every ſide the whole length, garniſhed with narrow, ſpear-ſhaped, hairy leaves, terminating in acute points, ſawed on their edges; theſe, when rubbed, emit a diſagreeable odour. The flowers grow from the foot-ſtalks of the leaves, to which they ſit very cloſe, having two pretty large leafy appendages to their empalements. The flowers are of a pale yellow colour, compoſed of five large oval petals, whoſe tails are twiſted and join; theſe are ſucceeded by ſhort tubular capſules, having one cell, which opens at the top with three valves, which turn back, and let out the ſeeds.

The ſecond ſort has a ſhrubby ſtalk like the firſt, and riſes to near the ſame height. The branches of this are ſlender, and ſtiffer than thoſe of the former. The leaves are oval, ſpear-ſhaped, rough on their upper ſide, and of a lucid green; their under ſide has many ſtrong veins, and is of a lighter colour; they are ſawed on their edges, and have longer foot ſtalks than thoſe of the firſt ſpecies. The flowers ſit cloſe upon the foot-ſtalks of the leaves, in like manner as the former; but the flowers are larger, and of a brighter yellow than thoſe. Theſe differences remain conſtant, and never alter when raiſed from ſeeds; ſo that from near thirty years experience in ſowing the ſeeds, I may pronounce them different ſpecies.

The plants are eaſily propagated by ſowing their ſeeds on a hot-bed early in the ſpring; and when the plants are come up two inches high, they ſhould be tranſplanted into ſmall pots, and plunged into a hot-bed of tanner's bark, obſerving to water and ſhade them until they have taken root; after which they muſt be treated like other tender plants from the ſame countries. The ſeeds of theſe plants will often fall into the pots which are placed near them in the ſtove, which will grow, and ſoon furniſh plants enough, after a perſon is once poſſeſſed of them. As they are too tender to live in the open air in England, they muſt be placed in the bark-bed in the ſtove, where, during the winter ſeaſon, they muſt be kept warm, and frequently watered; but in the ſummer-ſeaſon they muſt have a great ſhare of air, otherwiſe they will draw up tender, and not produce many flowers.

When the plants are grown pretty large, they may be treated more hardily, by placing them in the dry ſtove, where, if they are kept in a moderate degree of heat, they will thrive and flower very well. Thoſe who would ſave the ſeeds of theſe plants, muſt watch them carefully, becauſe, when they are ripe, they ſoon ſcatter if they are not gathered.

Theſe plants produce their flowers great part of the year, if they are kept in a proper degree of warmth; ſo that there are ſome of the flowers in beauty for at leaſt nine or ten months, which renders the plants more valuable. *Miller's Gard. Dict.*

TURNING, a branch of ſculpture, being the art of faſhioning hard bodies, as braſs, ivory, wood, &c. into a round or oval form, in a lathe.

Turning is performed by putting the ſubſtance to be turned upon two points as an axis, and moving it round on that axis; while an edge-tool, ſet ſteady to the outſide of the ſubſtance in a circumvolution thereof, cuts off all the parts which lie farther off the axis, and makes the outſide of that ſubſtance concentric to the axis. See the article LATHE.

The invention of turning ſeems to have been very ancient. Some, indeed, to do honour to the age, will have it brought to perfection by the moderns; but, if what Pliny and ſome other ancient authors relate, be true, that the ancients turned thoſe precious vaſes enriched with figures and ornaments in relievo, which we ſtill ſee in the cabinets of the curious, it muſt be owned that all that has been added in theſe ages, makes but a poor amends for what we loſt of the manner of turning of the ancients.

The lathe, or principal inſtrument uſed in turning, is compoſed of two wooden cheeks, or ſides parallel to the horizon, having a groove, or opening between them;

perpendicular to theſe are two pieces, called heads or puppets, made to ſlide between the cheeks, and to be fixed down at any point at pleaſure: theſe have two points or center pins, between which the piece to be turned is faſtened by the help of a ſcrew. There is alſo a ſquare piece of wood called a reſt, which bears up the tool, and keeps it ſteady. The piece is turned round backwards and forwards, by means of a ſtring put round it, and faſtened above to the end of a pliable pole, and below to a treddle or board moved by the foot. This is the common lathe; but there is another uſed in hollow turning &c. very different from it.

This lathe is compoſed like the other of two cheeks, and has alſo two heads fitted to ſlide between them; but has no pole, being turned by means of a wheel and a pully. The pully is faſtened on a kind of ſpindle called a mandrel, one end of which is pointed, and received into the center of the back ſcrew, which goes through one of the heads; and near the other end, called the verge, it moves in a piece called the collar; the end of the mandrel paſſes through the collar, and on it the piece to be turned is faſtened. Theſe deſcriptions will be rendered abundantly more eaſy from the two perſpective views on plate CXXXIII. which repreſent both theſe kinds of lathes in ſo conſpicuous a manner, that a full idea of both may be eaſily attained.

Fig. 1. is the lathe uſed by hollow turners, &c.

1. The lathe. 2. The groove. 3, 3. The heads or puppets. 4. The pully. 5. The mandrel. 6. The collar. 7. The back-ſcrew. 8. The reſt. 9. The wheel. 10. The crank. 11. The treddle.

There are ſeveral kinds of mandrels, adapted to the different kinds of work; as

Flat mandrels, which have three or more little pegs or points, near the verge, and are uſed for turning flat pieces on.

Pin mandrels, which have long wooden ſhanks, to fit into round holes in the work to be done.

Hollow mandrels, which are hollow of themſelves, and uſed for turning hollow work.

Screw mandrels, which are uſed in turning ſcrews.

There are a great variety of other inſtruments uſed in turning, as chiſſels and gouges of different kinds, perſpective views of moſt of which are repreſented in the figure. Thus, 12. Is a tool called a holdfaſt. 13. A point tool. 14. A broad chiſel called a firmer.

Fig. 2. is a perſpective view of the common lathe.

1. The lathe. 2, 2. The heads or puppets. 3. The pole. 4. The treddle. 5, 5. Screws which fix the reſt at a proper height. 6, 6. The reſt. 7. The back-ſcrew.

The workman ſtands, or is ſeated in his lathe, having one of his feet on the treddle to give the motion, which muſt be very moderate and equal; he places his tool on the reſt, and approaches the edge of it gently to the piece, performing his work gradually, without leaving any ridges; and, when he meets with a knot, he muſt go on ſtill more gently, otherwiſe he would be in danger both of ſplitting his work, and breaking the edge of his tool.

The two perſpective views on the plate will give a better idea of the nature of turning, than is poſſible to be conveyed by words. The firſt figure ſhews the nature of hollow turning, and the ſecond that for common work.

TURNING-EVIL, in cattle, a diſeaſe that cauſes them frequently to turn round in the ſame place. It is alſo called the ſturdy. The common remedy, recommended by Mr. Markham, is to throw the beaſt down, and bind him; then to open his ſkull, and take out a little bladder, filled with water and blood, which uſually lies near the membrane of the brain, and then gradually heal the wound.

TURNIP, or TURNEP, in botany, an eſculent plant, of which there are three ſpecies enumerated by Miller. The firſt is the turnip which is commonly cultivated in the fields, of which there are the following varieties, viz. the round red or purple topped turnip, the green topped turnip, the yellow turnip, the black rooted turnip, and the early Dutch turnip. The laſt ſort is commonly ſown early in the ſpring, to ſupply the markets in May and June, but is never cultivated for a general crop.

The red rooted turnip was formerly more cultivated in England than at preſent; for ſince the large green topped turnip has been introduced, all the ſkilful farmers preſer it to the other ſorts; the roots of the green will grow to a large ſize, and continue good much longer than the other ſorts. The next to this is the red or purple topped turnip, which will alſo grow large, and is extremely good for ſome time; but the roots of this will become ſtringy much ſooner than thoſe of the green topped. The long rooted turnip, the yellow turnip, and the blackiſh rooted turnip, are now rarely cultivated, in England, neither of them being ſo good for the table or for feed, as the red and green topped turnip, though there are ſome few perſons who ſow them for the ſake of variety.

The French turnip is not much cultivated in England, but in France and Holland they are in great eſteem, eſpecially for ſoups; their roots being ſmall, are boiled whole in the ſoup, and ſo ſerved up to the table; theſe muſt be uſed while they are young, otherwiſe they will become rank and ſtringy.

Theſe are ſuppoſed to be only varieties, which have accidentally been obtained from ſeeds, therefore I have not enumerated them as diſtinct ſpecies; but yet I am certain they are conſtant, where care is taken in the ſaving of their ſeeds, not to ſuffer any mixture to ſtand for ſeeds: I have ſown of three or four ſorts ſeveral years, and have always found them retain their differences; however, it is not eaſy to determine if ſome of theſe were not by culture firſt obtained from ſeeds of the common white turnip. The yellow turnip ſeems moſt unlikely to have been an accidental variety, for I have never known this alter, and the roots are yellow within, whereas all the other have white fleſh, notwithſtanding their outſides are of very different colours.

The long rooted turnip is, I think, a diſtinct ſpecies, the form of the root, and its manner of growth being totally different from the other ſorts. I have ſeen theſe roots as long as thoſe of the parſnip, and nearly of the ſame ſhape; theſe run deep into the ground, ſo are unfit for feeding of cattle; and unleſs they are uſed very young, become ſtrong, ſo not proper for the table, which has occaſioned their being rejected of late years.

The green topped turnip grows above ground more than any of the other, which renders it preferable for feeding of cattle; and being the ſofteſt and ſweeteſt root when grown large of any of the kinds, is moſt eſteemed for the table; but in very ſevere winters they are in greater danger of ſuffering by froſt, than thoſe whoſe roots lie more in the ground, eſpecially if they are not covered by ſnow; for when they are frequently hard frozen and thawed, it cauſes them to rot ſooner than thoſe whoſe fleſh is leſs tender and ſweet. I have ſeen the roots of this ſort, which were more than a foot diameter, boiled, and were as ſweet and tender, as any of the ſmalleſt roots.

Turnips delight in a light, ſandy, loamy ſoil, which muſt not be rich; for in a rich ſoil they grow rank and are ſticky, but if it be moiſt they will thrive the better in ſummer, eſpecially in freſh land, where they are always ſweeter than upon an old worn-out or a rich ſoil.

The common ſeaſon for ſowing of turnips, is any time from the beginning of June to the middle of Auguſt, or a little later; though it is not adviſeable to ſow them much after, becauſe, if the autumn ſhould not prove very mild, they will not have time to apple before winter, nor will the roots of thoſe which are ſown after the middle of July, grow very large, unleſs the froſt keeps off long in autumn. But, notwithſtanding this is the general ſeaſon in which the greateſt part of turnips are ſown in the country, yet, about London, they are ſown ſucceſſively from March to Auguſt, by thoſe who propagate them to ſupply the markets with their roots; but there is a great hazard of loſing thoſe which are ſown early in the year, if the ſeaſon ſhould prove dry, by the fly, which will devour whole fields of this plant while young; ſo that where a ſmall quantity for the ſupply of a family is wanted, it will be abſolutely neceſſary to water them in dry weather; and where a perſon ſows thoſe ſeeds in April and May, it ſhould always be upon a moiſt ſoil, otherwiſe they ſeldom come to good, the

heat

heat of the weather at that ſeaſon being too great for them upon a dry ſoil; but thoſe which are ſown towards the middle or latter end of June, commonly receive ſome refreſhing ſhowers to bring them forward; without which, it is very common to have them all deſtroyed.

Theſe ſeeds ſhould always be ſown upon an open ſpot of ground; for if they are near hedges, walls, buildings, or trees, they will draw up, and be very long topped, but their roots will not grow to any ſize.

They are ſown in great plenty in the fields near London, not only for the uſe of the kitchen, but for food for cattle in winter, when there is a ſcarcity of other food; and this way is become a great improvement to barren ſandy lands, particularly in Norfolk, where, by the culture of turnips, many perſons have doubled the yearly value of their ground.

The land upon which this ſeed is ſown, ſhould be ploughed in April, and twy-fallowed in May, that is, once more ploughed and twice well harrowed, and made very fine; then the ſeed ſhould be ſown pretty thin; for it being ſmall, a little will ſow a large piece of ground; one pound is the common allowance for an acre of land. The ſeed muſt be harrowed in as ſoon as it is ſown, with a ſhort-tinned harrow, and the ground rolled with a wooden roll, to break the clods, and make the ſurface even. In ten days or a fortnight after ſowing, the plants will come up; at which time, if the ſeaſon ſhould prove dry, they will be in great danger of being deſtroyed by the fly; but if it ſo happen, the ground muſt be ſowed again, for the ſeed being cheap, the chief expence is the labour; but the ground ſhould be firſt harrowed to looſen it, eſpecially if it is ſtiff land.

When the plants have got four or five leaves, they ſhould be hoed to deſtroy the weeds, and to cut up the plants where they are too thick, leaving the remaining ones about ſix or eight inches aſunder each way, which will be room enough for the plants to ſtand for the firſt hoeing; the ſooner this is performed, when the plants have four leaves, the better they will thrive; but in the ſecond hoeing, which muſt be performed about a month after the firſt, they ſhould be cut up, ſo as that the remaining plants may ſtand fourteen or ſixteen inches diſtance, or more, eſpecially if they are deſigned for feeding of cattle; for where the plants are allowed a good diſtance, the roots will be proportionably large; ſo that what is loſt in number, will be over-gained by their bulk, which is what I have often obſerved. But in ſuch places where they are ſown for the uſe of the kitchen, they need not be left at a greater diſtance than ten inches or a foot, becauſe large roots are not ſo generally eſteemed for the table.

It is not many years ſince the practice of ſowing turnips for feeding of cattle, has been of general uſe; how it happened that this improvement ſhould have been ſo long neglected in every part of Europe, is not eaſy to determine, ſince it is very plain, that this piece of huſbandry was known to the ancients. For Columella, in treating of the ſeveral kinds of vegetables which are proper for the field, recommends the cultivating *rapa* in plenty; becauſe, ſays he, thoſe roots which are not wanted for the table, will be eaten by the cattle: yet this plant was not much cultivated in the fields till within the laſt ſixty or ſeventy years; nor is the true method of cultivating turnips yet known, or at leaſt not practiſed, in ſome of the diſtant counties of England, at this time. For in many places the ſeed is ſown with barley in the ſpring, and thoſe plants which come up, and live till the barley is cut, produce a little green for the ſheep to pick up, but never have any roots. In other places, where the turnip ſeed is ſown by itſelf, the method of hoeing them is not underſtood; ſo that weeds and turnips are permitted to grow together; and where the turnips come up thick in patches, they are never thinned, ſo that they draw up to have long leaves, but never can have good roots, which is the principal part of the plant, therefore ſhould be chiefly attended to.

The general method now practiſed in England, for cultivating this plant in the fields, is the ſame as is practiſed by the farming gardeners, who ſupply the London markets with theſe roots, and is the ſame as before directed. But it is only within the compaſs of a few years, that the country people have been acquainted with the method of hoeing them; ſo that the farmers formerly employed gardeners, who had been bred up in the kitchen gardens, to perform this work; but it is now performed by many country labourers, by which means that practice is loſt to the kitchen gardeners; the labourers doing it much cheaper.

There has alſo been another method practiſed very lately, by ſome very curious farmers, in cultivating of turnips, which is by ſowing the ſeed in rows, with the drill-plough. In ſome places the rows are ſown three feet aſunder, in others four, in ſome five, and ſome ſix. The latter has been recommended by ſome, as the moſt proper diſtance; and although the intervals are ſo large, yet the crop produced on an acre has been much greater than upon the ſame quantity of land, where the rows have been but half this diſtance; and upon all the fields which have been tilled, the crops have greatly exceeded thoſe which have been hand-hoed. The late lord viſcount Townſhend was at the expence of making the trial of theſe two different methods of huſbandry, with the greateſt care, by equally dividing the ſame fields into different lands, which were alternately ſown in drills, and the intermediate lands in broad caſt. The latter were hoed by hand, in the common method, and the other cultivated by the hoeing-plough; and when the roots were fully grown, his lordſhip had an equal quantity of land, which had been ſowed in the different methods, meaſured, and the roots drawn up and weighed; thoſe roots which had been cultivated by the plough, were ſo much larger than the other, that the crop of one acre weighed a ton and half more than that of an acre in the other huſbandry.

But when the turnips are ſown in drills, they will require to be hoed by hand, to ſeparate and cut out the plants, where they are too near together in the rows; as alſo to cut up the weeds between the plants, where the plough cannot reach them. If this is carefully performed, the ploughing of the intervals will encourage the growth of the roots, by thus ſtirring of the ground, and make it much better prepared for the crop of barley, or whatever elſe is ſown the following ſpring. This method of culture may be ſuppoſed to be more expenſive than that commonly practiſed, by thoſe unacquainted with it; but thoſe who have made trial of both, find the horſe-hoeing to be much the cheapeſt, and by far the beſt. For the country people, who are employed in hand-hoeing of turnips, are very apt to hurry over their work, ſo that half the weeds are left growing, and the plants are ſeldom ſingled out ſo well as they ſhould be; nor are they curious enough to diſtinguiſh the charlock, which is one of the moſt common weeds in arable land, from the turnips; ſo that about the middle of September, it is very common to ſee the fields of turnips full of the yellow flowers of the charlock. Now, in the horſe-hoeing, all the weeds in the intervals will be entirely deſtroyed; ſo that if a few plants in the rows of turnips ſhould be overlooked, they may be eaſily drawn when they appear viſible, and by this method the land will be ſooner and better cleaned from weeds.

The greateſt evil which attends a crop of turnips, is that of their being deſtroyed by the fly, which uſually happens ſoon after the plants come above-ground, or while they are in the ſeed-leaf; for, after they have put out their rough leaves pretty ſtrong, they will be paſt this danger. This always happens in dry weather; ſo that, if there ſhould be rain when the turnips come up, they will grow ſo faſt, as to be in a few days out of danger from the fly; and it hath been found, that thoſe, which have been ſown in drills, have eſcaped the fly much better than thoſe ſown in broad caſt; but, if ſoot is ſown along the ſurface of each drill, it will be of great ſervice to keep off the fly, and a ſmall quantity of it will be ſufficient for a large field, where the drills only are to be covered.

Another danger of the crops being deſtroyed is from the caterpillars, which very often attack them, when they are grown ſo large as to have ſix or eight leaves on a plant. The ſureſt method of deſtroying theſe inſects, is to turn a large parcel of poultry into the field, which ſhould be kept hungry, and turned early in the morning

into

into the field; theſe fowls will ſoon devour the inſects, and clear the turnips. To this evil the turnips, which are ſown in drills, are not ſo much expoſed; for as the ground between the rows will be kept ſtirred, the plants will be kept growing, ſo will not be in danger of ſuffering from theſe inſects, for the parent inſects never depoſit their eggs upon any plants which are in health; but as ſoon as they are ſtinted, they are immediately covered with the eggs of theſe inſects; and this holds in general with vegetables as with animals, who are ſeldom attacked by vermin when they are in perfect health; whereas, when they become unhealthy, they are ſoon overſpread with them; ſo that it is the diſeaſe which occaſions the vermin, and not the vermin the diſeaſe, as is commonly imagined.

When the turnips are ſown in drills, it will be the beſt way to plough between every other row at firſt, and ſome time after to plough the alternate intervals, by which method the plants will receive more benefit from the often ſtirring the ground than they would do, if all the intervals were hoed at one time; and plants will be in leſs danger of ſuffering from the earth being thrown up too high on ſome rows, while others may be left too bare of earth; but, when the earth has been thrown up on one ſide of the drill, it may be turned down again ſoon after the next interval is ploughed. This alternate moving of the earth will prepare the ground very well for the ſucceeding crop, and greatly improve the turnips; but, as the plough cannot well be drawn nearer to the drills than two or three inches, the remaining ground ſhould be forked to looſen the parts, and make way for the fibres of the roots to ſtrike out into the intervals; otherwiſe, if the land is ſtrong, it will become ſo hard in thoſe places which are not ſtirred, as to ſtint the growth of the turnips. This may be done at a ſmall expence; a good hand will perform a great deal of this work in a day, and, whoever will make the trial, will find their account in practiſing it, eſpecially on all ſtrong land, where the turnips are much more liable to ſuffer from the binding of the ground, than they will be on a looſe ſoil; but yet, in all ſorts of ground, it will be of great ſervice to practiſe this.

When the ground is thus ſtirred in every part, one ploughing will be ſufficient, after the turnips are eaten, for the ſowing of barley, or any other crop; ſo that there will be an advantage in this, when the turnips are kept late on the ground, as will often be the caſe, eſpecially when they are cultivated for feeding of ewes, becauſe it is often the middle of April before the ground will be cleared; for late feed in the ſpring, before the natural graſs comes up, is the moſt wanted, where numbers of ſheep or ewes are maintained, and one acre of turnips will afford more feed than fifty acres of the beſt paſture at that ſeaſon.

In Norfolk and ſome other counties they cultivate great quantities of turnips for feeding of black cattle, which turn to great advantage to their farms, for hereby they procure a good dreſſing for their land; ſo that they have extraordinary good crops of barley upon thoſe lands, which would not have been worth the ploughing, if it had not been thus huſbanded.

When the turnips are fed off the ground, the cattle ſhould not be ſuffered to run over too much of the ground; for, if they are not confined by hurdles to as much as is ſufficient for them one day, the cattle will ſpoil three times the quantity of turnips as they can eat, ſo that it is very bad huſbandry to give them too much room; therefore the hurdles ſhould be every day removed forward, and if the turnips are drawn out of the ground before the cattle or ſheep are turned into the new incloſure, there will be leſs waſte made, for they will then eat up the whole roots; whereas, if they are turned upon the turnips growing, they will ſcoop the roots, and leave the rinds, which being hollow, the urine of the ſheep will lodge in them; ſo that, when they are forked out of the ground, the ſheep will not eat any of thoſe roots which are thus tainted.

I cannot omit taking notice of a common miſtake, which has generally prevailed with perſons who have not been well informed to the contrary, which is in relation to the mutton which is fatted with turnips, moſt people believing it to be rank and ill taſted; whereas it is a known fact, that the beſt mutton this country affords is all fatted on turnips, and that rank mutton, whoſe fat is yellow, is what the low marſhy lands of Lincolnſhire, and other rank paſtures, produce.

In order to ſave good turnip ſeeds, you ſhould tranſplant ſome of the faireſt roots in February, placing them at leaſt two feet aſunder each way, obſerving to keep the ground clear from weeds, until the turnips have ſpread ſo as to cover the ground. When they will prevent the weeds from growing; when the pods are formed, you ſhould carefully guard them againſt the birds, otherwiſe they will devour it, eſpecially when it is near ripe; at which time you ſhould either ſhoot the birds as they alight upon the ſeed, or lay ſome bird-limed twigs upon it, whereby ſome of them will be caught; and, if they are permitted to remain ſome time, and afterwards turned looſe, they will prevent the birds from coming thither again for ſome time, as I have experienced. When the ſeed is ripe it ſhould be cut up, and ſpread to dry in the ſun; after which it may be threſhed out, and preſerved for uſe.

There have been many receipts for preventing the fly taking turnips, but few of them deſerve notice, therefore I ſhall only mention two or three which I have ſeen tried with ſucceſs. The firſt was ſteeping the ſeeds in water with flour of brimſtone mixed, ſo as to make it ſtrong of the brimſtone: another was ſteeping it in water with a quantity of the juice of horſe-aloes mixed, both which have been found of uſe. The ſowing of ſoot or tobacco duſt over the young plants, as ſoon as they appear above ground, has alſo been found very ſerviceable: in ſhort, whatever will add vigour to the young plants, will prevent their being deſtroyed by the fly, for thoſe never attack them, till they are ſtinted in their growth. *Miller's Gard. Dict.*

Mr. Liſle is inclined to think, that the beſt way to manage turnips, the ſeed of which, ſays he, is impatient of growth, and apt to burſt in too much wet, as alſo to corrupt, if the ground be ſo dry as only to give it a damp, but not wet enough to ſet it on growing, is, firſt to harrow the ground fine, after it has been brought to a perfect tilth by ploughing, then to roll it with a roller big enough to break the little clods, if any ſuch remain, and ſo let it lie till the next rain; then, the ground being mellow, to ſow the ſeed, and harrow it in with ſhort-tinned harrows, which may not open the ground too deep, nor bury the ſeed; then roll it again with a one-horſe roller, in order to keep the moiſture in the ground as deep as the ſeed may be: for the ſurface of the earth muſt not be dried before the ſeed can ſtrike root, which may be in twice twenty-four hours; and yet that ſurface muſt be ſo fine, and ſo lightly compreſſed, that the ſeed may ſpear through it. He takes the myſtery, as he calls it, of the ſucceſs or miſcarriage of a crop of turnips to conſiſt in theſe four things, viz. firſt, in the ſeed's not lying too deep; ſecondly, in its not lying too wet, which it cannot eaſily do if harrowed in ſhallow, for the ſurface of the earth is ſoon dry; thirdly, in its not lying too dry; and fourthly, in its lying in a fine bed. In another place, he tells us, that his gardener affirmed to him, that he had found turnip ſeeds, which had been dropped by accident and covered over with earth in digging, freſh and good a year after, when the earth was turned back again, and that it has then grown and produced good turnips. The reaſon is, that every ſeed which is buried ſo deep as not to be affected by the changes in the air, may remain in a ſound ſtate, and in a fit condition to vegetate, for many years, as hath been evinced by numbers of inſtances.

Mr. Duhamel adviſes after the two firſt hoeings a ſlight ploughing all over the field, with a plough that has no fins to the ſhare, as a ſpeedier and cheaper way to thin the plants: the turnips will not require any farther care. They will have attained their full ſize in October, before the froſts come, and ſhould then be taken up, ſtripped of their leaves, which may be given to cattle, and laid upon hurdles in a dry place, with a layer of dry ſand between each layer of turnips, which may be thus piled up, and which will keep very well in this condition, for the food of cattle during the winter. In Norfolk, they

ſtow them in their barns, when intended for fattening of bullocks.

A dry ſeaſon is the beſt for hoeing turnips, becauſe neither the weeds nor the turnips hoed up then will be ſo apt to grow again: and Mr. Liſle ſuppoſes that care ſhould be taken to hoe up thoſe that are deepeſt rooted in the earth, and to leave thoſe that grow upon, and almoſt out of it, without much regarding their ſize; becauſe thoſe which lie on the ground, and have room to grow, will ſoon become the largeſt.

Some ſow turneps on their flax and hemp grounds, at the ſame time as they pluck up thoſe plants, and the ſeed is pretty well buried by the ſtirring thereby given to the earth. Others give their corn ſtubble only a ſlight plowing after harveſt, then ſow the turnips very thin, and harrow in the ſeed. Theſe methods do very well when the ground is in good tilth. Others again, ſow late turneps, merely for the ſake of their leaves, which they uſe as green feed, when they are about a foot high; and in this caſe they ſow the ſeed very thick.

An eaſy way to have two growths of turnips in the ſame field, is to ſow ſeed of the laſt gathering, and ſeed that is two years old; for this laſt is longer before it riſes, than the new: and an advantage attending this method, is, that the turnips, by riſing at different times, will have the better chance to eſcape the fly, or grub, which ſometimes deſtroy them entirely: for it has been obſerved, that theſe flies often come ſuddenly in great ſwarms, and eat up the turnips as faſt as they riſe; and that they ſometimes diſappear as ſuddenly; ſo that the turnips which riſe a few days after, in a neighbouring field, are not at all injured by them: conſequently, when the turnips of the ſame field riſe at different times, one or other may eſcape the ravage of theſe inſects; for they deſtroy them only while in their ſeed leaf.

The worm to which turnips are very liable may be guarded againſt, at leaſt in a great meaſure, as Mr. Liſle informs us, by liming the ground. This will alſo render them much ſweeter than they would otherwiſe be: and we are of opinion that freſh ſlaked lime ſtrewed over the ground when the turnip ſeed is ſown, will contribute greatly to preſerve the young plants from the fly. It is to the worm lodged in the root of the turnip, perhaps engendered from the egg of the fly, that Mr. Liſle imputes the diſtemper or diſeaſe in turnips, which the Norfolk farmers call the hanbery; ſo named from a like diſtemper in a horſe's heel. It is a warty excreſcence, formed probably by this inſect, in the ſame manner as galls are formed upon the leaves of the oak. In ſome years it takes off whole crops, and the turnips never thrive after it has begun to grow in them.

A gentleman, remarkable, among many other good qualities, for ſeveral excellent improvements which he has made in agriculture, tried with ſucceſs the following experiment, to preſerve turnips from the fly, and the better to ſecure their growth. He ſowed the ſeed in a nurſery, where there was leaſt danger of ſlugs or the fly, and where they might eaſily be watered in caſe of great drought, to make them grow the quicker. They remained in this nurſery, till they were large enough to be tranſplanted. By this means he gained ſome weeks longer, to perfect his fallow, or give a thorough plowing to ground which had borne a crop that ſeaſon. He tranſplanted his turnips into the field, and by planting them regularly at due diſtances, greatly leſſened the expence of hoeing; their regularity making it very eaſy to deſtroy the weeds from time to time, as they appeared.

In the ſecond part of the Memoirs of the Society of Berne for the year 1762, the reverend Mr. Bertrand, not ſatisfied with even a ſcrupulous diſcharge of the duties of his clerical function, has inſtructed his pariſhioners, his country, and mankind, in the important ſubject of agriculture. The improving of light ſoils by the culture of turnips, is one of his objects: upon which he very judiciouſly obſerves, that though it be right to plough ſtiff lands before the winter, in order to their being mellowed by the froſt; yet as the fineſt and beſt parts of the ſoil will be in danger of being waſhed off, or carried down into the looſe earth underneath, when this is done in a light ground, or in mould which has a ſandy or gravelly bottom; it will be moſt adviſeable here, to turn the ſtubble down immediately after the corn has been taken off, and then to ſow turnips; becauſe their ſpreading leaves will ſhelter and ſecure the fine mould upon the ſurface, and keep the land in good heart, whilſt the earth will be looſened and divided by their roots, ſo that it will be rather fitter for a ſpring crop, than if it had lain uncultivated.

The chief uſe of turnips is, to feed cattle in the winter and ſpring, when there is a want of graſs for their paſture. Cows, oxen, and hogs, are very fond of this food, which fattens them, and increaſes the milk of the former. Sheep too eat it readily, and thrive upon it, when they have been uſed to it early; but they do not reliſh it when it has not been offered them till they are grown old: however, if they are kept faſting two or three days, moſt of them take to it, and when they have once taſted it, they become very fond of, and feed kindly upon it. In ſome places, they feed their lambs with turnips till the middle of April, though they then begin to run up to ſeed. Farmers chooſe rather to do this, than to let them hurt their clover, ſain-foin, lucerne, &c. Some par-boil them a little, at firſt, till their cattle, and particularly their ſheep, are accuſtomed to them: but a lamb only three weeks old, will, after it has once eaten of this food, ſcoop out a raw turnip with great glee.

Turneps, if not clean eaten, and well cleared off the ground, may take root again, run to ſeed, and do great damage to the enſuing crop. Mr. Liſle inſtances it in a gentleman of Berkſhire, who plowed up a turnip field in the ſpring, and ſowed it with peas: but the little dwarf turnips that were left behind, uneaten, notwithſtanding his plowing them up, took root again, run to ſeed in great quantities, and did much damage to his crop of peas.

The practice of turning a flock of ſheep, at random, into a large field of turnips, is very bad: for they will then ſpoil more in a fortnight, than would keep them a whole winter. The beſt way, therefore, of feeding them with theſe roots, is, as Mr. Tull adviſes, and after him M. Duhamel, one or other of the three following methods, which are equally applicable to the drill, and to the common, huſbandry.

The firſt is, to portion out the turnip ground, by incloſing with hurdles ſo much only as the ſheep can clear in one day; and ſo to advance the folds farther into the field every morning, until all be ſpent. But it is to be obſerved, that the ſheep never eat them clean this way, but take only the leaves and the heart of the turnip: ſo that great part of them remains in the earth. It is true that theſe fragments, if left there, rot, and become a manure: but when they are wanted for the food of the flock, and are to that end pulled up with iron crooks or forks made for this purpoſe, the ſheep do not reliſh, and conſequently eat but little of, theſe then dirty withered remains, tainted with their urine, dung, &c. nor can they nouriſh them ſo well as roots which are freſh and cleanly.

The ſecond method differs from the former only in pulling up the turnips ſo far as they are hurdled off, before the ſheep are turned in. They then eat them better, becauſe the food is freſh and in good condition. Beſides, as the whole turnips are pulled up more eaſily than their pieces can be, there is not ſuch waſte as in the other way. The turneps which grow next to the hurdles ſhould be thrown towards the middle of the ſpace hurdled off; becauſe they will be leſs liable to be trampled upon and ſpoiled there, than nearer to the hurdle, where the ſheep run about moſt, in ſearch of means of eſcaping into the open field.

The third way is to pull up the turnips, and carry them into ſome other ground, and there ſpread them every day on a new place, where the ſheep will eat them up clean. This is done when there is land not far off, which has more need of dung than that where the turnips grow. The expence of carrying the turnips is compenſated by ſaving the price, or at leaſt the carriage and removing of the hurdles: only when the turnips are laid on a ſpot of graſs, as is frequently done in wet weather, the benefit of the dung and urine of the ſheep is loſt.

This method is requiſite when the field on which the

turnips grow is wet; becauſe, 1. The ſheep would trample upon, and bury, part of the turnips, which would be loſt. 2. In treading that wet earth, they would poach it, and render it unfit for corn. 3. By this means, a field may be dunged, as we have juſt obſerved, which wants it more than that where the turnips grew. 4. This muſt neceſſarily be done, if wheat has been ſown in the alleys between the rows of turneps, according to the principles of the new huſbandry.

Turnips are always carried off the field, when they are intended to fatten the larger ſorts of cattle: and they ſhould be cut in pieces for them, leſt they choak themſelves with the whole ones. They are given morning and evening to ſtall-fed cattle, which in the intervals, eat likewiſe common fodder; but the turnips increaſe their appetite to ſuch a degree, that a middle ſized bullock, ſtalled for fattening, will conſume near 200 pounds weight of theſe roots in 24 hours, beſides hay: whereas, if nothing but hay were given him, he would hardly eat half the quantity that he will with the turneps. A healthy bullock, in only good plight at the time of his beginning to be fed with turnips, will be very well fattened in three months.

Mr. Tull ſays he found by experience, that the beſt way of ſowing turneps is in ſingle rows, ſix feet aſunder. He ſowed them in double rows, alſo at that diſtance, but they did not do well: and he likewiſe ſowed them in ſingle rows, with intervals of only three feet. Theſe laſt yielded a greater crop than a neighbouring field, which was ſown and managed in the common way: but neither the ſingle rows three feet aſunder, nor the double rows with intermediate diſtances of ſix feet, yielded, ſays he, half ſo much, as the ſingle rows ſix feet aſunder: from whence he concludes, that it is beſt to leave a ſpace of ſix feet between the rows; for that, if the alleys are well plowed, theſe turneps will thrive wonderfully, even though no other moiſture falls but the dew, which will ſink into the earth, to their roots.

However, notwithſtanding Mr. Tull's experiment, M. Duhamel is for ſowing turneps in double rows, if the intervals are of ſix feet; or if they are ſown in ſingle rows, he would have theſe rows be but four feet aſunder, which is the ſpace left between the rows of vines in Languedoc, and which is there plowed with oxen.

An ounce of ſeed will ſow as much land when drilled, as a pound will in the common way: and if care be taken to diſtribute only the neceſſary quantity, a great deal of trouble will be ſaved in the hoeing of the plants afterwards, to thin them. But it is eſſential to obſerve, we muſt again repeat it, that all roots, whether turnips, carrots, parſneps, parſley, or any other, always thrive beſt where there is a great depth of fine, light, well looſened mould. M. Duhamel trenched the whole of his kitchen-garden three feet deep: all his pot-herbs grew very fine, and his roots in particular were of a ſurprizing ſize.

Mr. Tull, by drilling his turnip ſeeds alternately at different depths in the earth, was ſure to ſucceed in one part or other, whether the ſeaſon was wet or dry. If wet, the ſeed ſlightly covered ſprouted firſt; and in dry ſeaſons, that which lay deepeſt was the firſt that roſe. By this means, and by mixing the ſeed, half new and half old, for the new always comes up ſooneſt, he had four comings up, which, as he obſerves, gave the plants ſo many chances to eſcape the fly.

If one was ſure of having rain immediately after the turnips are ſown, it would undoubtedly be right to ſow them very ſhallow: but if no rain happens, they are beſt deeper in the earth, becauſe they there meet with moiſture ſufficient to make them grow.

When the ſeaſon has been ſo kindly that all the ſeeds have grown, and the plants have not ſuffered by the fly or other inſects, they muſt be thinned early, that the ground may not be exhauſted by ſuch as are not intended to remain; for thoſe that are left ſhould be about a foot aſunder.

When the turnips ſown in drills thrive well, only each alternate alley need be hoed at one time, and the others a few days after; it being better to feed the plants gradually, by dividing the hoeings in this manner, than to give them a great deal of food at once, by hoeing all the alleys together, and afterwards leave them double the time without any culture at all. Another advantage attending this method is, that the plants will be the leſs liable to be killed by hot dry weather, and the leſs apt to be damaged by heavy rains. But it will not, indeed, ſo effectually deſtroy weeds, which ought always to be a principal object of the huſbandman's care, and which ever is one of the chief intentions of the new huſbandry. However, as all weeds are very apparent in the alleys, it is eaſy to extirpate them there; and as to thoſe which may chance to be in the rows, the perſon who thins the turnips may cut them up at the ſame time. He will there moſt eaſily diſtinguiſh the charlock from the turnips, eſpecially when the leaves of theſe laſt are come to be about the breadth of a half crown.

All plants ſown in ſingle rows are greatly benefited by the alternate hoeing of the alleys between them: for, as M. Duhamel obſerves, 1. Four of theſe hoeings, which coſt no more than two entire ones, are almoſt as beneficial to the plants as four complete hoeings. 2. A plant which finds a great deal of nouriſhment on one ſide, is the better able to thrive without receiving ſo much on the other. 3. If, in hoeing very near the plant, ſome of its roots are broke; thoſe on the other ſide, not hoed, ſupply the wants of the plant, till the broken ones have made freſh ſhoots. 4. The horſe-hoe may therefore be brought very near to the turnips, without fear of hurting them; provided it do not force them out of the earth. 5. When a farmer has a great quantity of turneps to hoe, they are ſooner ſupplied by this culture, than they could poſſibly be if all the alleys were to be hoed,

A furrow ſhould not be left open near the turnips, while they are young; becauſe the earth about them would in that caſe become too dry: but there is no danger of this in the autumn, when they are grown ſtrong, and the earth is moiſt. Neither is it adviſeable to leave a furrow open near them during the winter; becauſe they would be in danger of being hurt by the froſt.

When theſe plants are grown large, and their roots are conſequently pretty well extended, the hoe-plough need not come quite ſo near them as at firſt: nor is it neceſſary to hoe them at all, till they are about the bigneſs of one's finger's end.

One alternate hoeing, or which is the ſame thing, two half hoeings, will be ſufficient when the turnips are ſown late. But when they are ſown early, and many weeds grow, one hoeing will not be enough.

By following this culture, M. Duhamel has ſeen turnips which weighed from ſixteen to nineteen pounds; and we may depend on their weighing one with another twelve pounds a-piece in a good ſoil, which is a vaſt produce from an acre of land. Mr. Miller ſays, that one acre of turnips, thus properly cultivated, will afford more feed for ſheep or ewes in the winter, than fifty acres of the beſt paſture at that ſeaſon.

Another vaſt advantage which attends the ſowing of turnips in rows, is, that inſtead of occupying the whole ground when it ſhould be ſowed with wheat, and ſometimes even when it ſhould be ſowed with ſpring-corn, as is frequently the caſe in the old way; they are no hindrance to either in the new huſbandry: for as the alleys are in good tilth, three rows of corn may be ſown, ſeven inches aſunder, between the rows of turnips; and when theſe roots are pulled up, the ground where they grew is hoed, and becomes the alleys between the beds of corn.

The beſt turnip ſeeds are obtained from the largeſt roots, which may either be tranſplanted for that purpoſe, or marked out in the field where they were ſown. Thoſe which are commonly ſold in the ſhops, ſeldom produce the fineſt plants.

We ſhall cloſe this article with the following

Experiments on TURNIPS *cultivated according to the new Huſbandry.* In 1754, M. de Chateauvieux ſowed turnips on beds, in two rows. They ſuffered greatly for want of rain, and none of them grew to the ſize they would have done in a more favourable ſeaſon. Some of them weighed eight pounds; but their general weight was from three to four.

In 1755, M. de Chateauvieux ſowed ſome beds with one row, ſome with two, and others with three rows.

They

They were afterwards thinned, ſo that the plants ſtood a foot aſunder in the rows. Thoſe ſown in one row were the largeſt, and in general, the moſt equal. Some of them weighed fourteen pounds, and moſt of them from ſeven to eight. In the other rows, they did not weigh ſo much; but they were more numerous.

In conſequence of theſe experiments, M. Duhamel, to whom they were communicated, makes the following ſtriking calculation relative to the quantity of food which turnips will afford for cattle.

"Let a ſquare whoſe ſide is 216 feet be formed into beds four feet wide, which is ſufficient for one row of turnips. Theſe will be 216 feet long, and conſequently will contain that number of turnips, planted a foot aſunder. Theſe 216 multiplied by 54, the number of beds, will give 11664 turnips for the product of the ſquare; and theſe multiplied by ſix, the ſuppoſed weight of each turnip, will give 69,984 pounds for the weight of all the turnips on this ſpot."

This may be looked upon as a very conſiderable crop; for it will be ſufficient to ſtall-feed four bullocks during the three winter months, at the daily allowance of 200 pounds each: and yet there is reaſon to believe that the quantity will be doubled in a good year, as will be pretty evident to thoſe who conſider at how low a rate the medium weight of the turnips is here eſtimated.

In 1755, M. Duhamel ſowed turnips in a field, on beds cultivated with the horſe-hoe. They grew extremely fine; many of them being twenty-nine inches circumference.

TURNPIKE, a gate ſet up a-croſs a road, watched by an officer for the purpoſe, in order to ſtop travellers, waggons, coaches, &c. to take toll of them towards repairing or keeping the roads in repair.

Juſtices of the peace, and other commiſſioners, are authorized to appoint ſurveyors of the roads, and collectors of toll, which is uſually 1s. or 6d. for a coach or waggon, and 1d. for a horſe, &c.

In caſe any perſons ſhall drive horſes or other cattle, through grounds adjoining to the highways, thereby to avoid the toll, they are liable to forfeit 10s. Likewiſe if any one aſſaults a collector of the tolls, or by force paſſes through a turnpike-gate without paying, he forfeits 5l. levyable by juſtices of peace; and maliciouſly pulling down a turnpike is deemed felony, &c. It is alſo enacted, that 20s. ſhall be paid for every hundred that a carriage with its loading weighs above 6000 pound weight, and that engines may be ſet up at turnpikes for weighing ſuch carriages.

TURNPIKE, is alſo uſed in the military art for a beam ſtuck full of ſpikes, to be placed in a gap, a breach, or at the entrance of a camp, to keep off an enemy. See CHEVAUX *de Friſe*.

TURNSOLE, or TORNSOLE, *Heliotropium*, in botany, a genus of plants whoſe flower is monopetalous and ſaucer-ſhaped; the tube is the length of the cup; the limb is plane, divided lightly into five ſegments, and obtuſe: the ſmaller ſegments ſtand alternate and are acute; the larger are placed between: the mouth is cloſed by five prominent ſquamulæ, joined in the form of a ſtar; there is no pericarpium, the calyx remains unaltered, and contains four oval acuminated ſeeds.

A decoction of common turnſole purges phlegm and bile. It is good againſt the ſting of ſerpents: the leaves are ſaid to take away warts, ulcers, gangrenes, and ſcrophulous tumours.

It is ſaid that the berry of the heliotropium, which grows wild about Montpelier, ſtains paper of a green colour, and that this green turns preſently to a blue: that the common blue paper receives its colour from this juice: and that the red rags called turnſole, employed for colouring wines and other liquors, are tinctured by the ſame juice turned red by acids. According to M. Niſſolle of the French Academy of Sciences, the colouring juice is obtained, not from the berries, but from the tops of the plant, gathered in Auguſt, ground in mills, and then committed to the preſs. The juice is expoſed to the ſun, moiſtened by the vapour which ariſes during the ſlaking of quick-lime with urine, then dried again in the ſun, and dipt again in the juice. The Dutch and others are ſaid to prepare turnſole rags, and turnſole in the maſs, from different ingredients, among which archil is a principal one.

TURPENTINE, *Terebenthina*, in the materia medica, a native balſam, or reſinous juice of certain trees, flowing either naturally or by inciſion. Four kinds of turpentine are diſtinguiſhed in the ſhops.

1. Chio, or Cyprus, turpentine, generally about the conſiſtence of thick honey, very tenacious, clear and almoſt tranſparent, of a white colour, with a caſt of yellow and frequently of blue, of a warm pungent bitteriſh taſte, and a fragrant ſmell more agreeable than that of any of the other turpentines. It is the produce of the common terebinth, an evergreen bacciferous tree or ſhrub, growing ſpontaneouſly in the eaſtern countries and in ſome of the ſouthern parts of Europe.

The turpentine brought to us is extracted in the iſlands whoſe name it bears, by wounding the trunk and branches a little after the buds have come forth: the juice iſſues thin and clear as water, and by degrees thickens into the conſiſtence in which we meet with it. A like juice, exuding from this tree in the Eaſt, inſpiſſated by a ſlow fire, is ſaid by Kæmpfer to be uſed as a maſticatory by the Turkiſh women, for preſerving the teeth, ſweetening the breath, and promoting appetite.

2. Venice turpentine, uſually thinner than any of the other ſorts, of a clear whitiſh or pale yellowiſh colour, a hot pungent bitteriſh diſagreeable taſte, and a ſtrong ſmell, without any thing of the fine aromatic flavour of the Chian kind. The true Venice turpentine is ſaid to be obtained from the larch, a coniferous tree, with ſmall cones, and ſhort leaves ſtanding in tufts, which fall off in the winter, growing in great abundance on the Alps and Pyreneans, and not uncommon in the Engliſh gardens. Though this kind of turpentine bears the name of Venice, it is not the produce of the Venetian territories: the greateſt quantities are brought from New England.

3. Straſburg turpentine, generally of a middle conſiſtence between the two foregoing, more tranſparent and leſs tenacious than either, in colour yellowiſh brown, in ſmell more agreeable than any of the other turpentines except the Chian, in taſte the bittereſt yet leaſt acrid. This juice is extracted, in different parts of Germany, from the ſilver and red fir, by cutting out, ſucceſſively, narrow ſtrips of the bark, from as high as a man can reach to within two feet of the ground. In ſome places, a reſinous juice is collected from certain knots under the bark: this is accounted ſuperior to the turpentine.

4. Common turpentine, about the conſiſtence of honey, of an opake browniſh white colour, the coarſeſt, heavieſt, in ſmell and taſte the moſt diſagreeable of all the kinds of turpentine. It is obtained from the wild pine, a low coniferous tree, with the leaves longer than thoſe of the firs, and iſſuing two together from one tubercle, growing wild in different parts of Europe. This tree is extremely reſinous, inſomuch that, if not evacuated by its juices, it often ſwells and burſts. The juice, as it iſſues from the tree, is received in trenches made in the earth, and afterwards freed from its groſſer impurities by colature thro' wicker baſkets. The cones of the tree appear to contain a reſinous matter of a more grateful kind than that of the trunk: diſtilled while freſh, they are ſaid to yield a fine eſſential oil greatly ſuperior to that of the turpentines.

All theſe juices diſſolve totally in rectified ſpirit, but give out little to watery menſtrua: they become miſcible with water, into a milky liquor, by the mediation of the yolk or white of an egg, and more elegantly by mucilages. Diſtilled with water, they yield a notable quantity of a ſubtile penetrating eſſential oil vulgarly called ſpirit; a yellow or blackiſh reſin remaining in the ſtill: this is the common roſin of the ſhops. It is ſuppoſed that the officinal Burgundy pitch, which is brought from Saxony, is a preparation of the ſame kind, only leſs diveſted of the oil, made by boiling the common turpentine till it acquires a due conſiſtence. The eſſential oil, rediſtilled by itſelf in a retort, with a very gentle heat, becomes more ſubtile, and in this ſtate is called ethereal, a thick matter remaining behind, called

balſam of turpentine. A like balſam is obtained alſo by diſtilling, with a ſtronger fire, the common reſin; from which there ariſes, firſt a thin yellow oil, and afterwards the thicker dark-reddiſh balſam, a blackiſh reſin remaining in the retort.

All the turpentines are hot ſtimulating corroborants and detergents. They are given, where inflammatory ſymptoms do not forbid their uſe, from half a ſcruple to half a dram and upwards, for cleanſing the urinary paſſages and internal ulcerations in general, and in laxities of the ſeminal and uterine veſſels. They ſeem to act in a peculiar manner on the urinary organs, impregnating the water with a violet ſmell, even when applied externally, particularly the Venice ſort. This laſt is accounted the moſt powerful as a diuretic and detergent, and the Chio and Straſburgh as corroborants: they all looſen the belly, the Venice moſt; and on this account they are ſuppoſed by Riverius and others to be leſs hurtful than ſuch irritating diuretics, as are not accompanied with that advantage. The common turpentine, as being the moſt offenſive, is rarely given internally: its principal uſe is in ſome external applications, among the farriers, and for the diſtillation of the oil.

The oil is a moſt potent ſtimulating detergent diuretic. It is ſometimes given, in doſes of a few drops, in rheumatiſms and fixed pains of the joints; and ſome have ventured on much larger quantities. Cheyne recommends, as a perfect cure for ſciaticas, though of many years ſtanding, from one to four drams of the ethereal oil, to be taken with thrice its quantity of honey, in a morning faſting, with large draughts of ſack-whey after it, and an opiate at bed-time: this medicine is to be repeated, with the intermiſſion of a day now and then, if daily repetitions cannot be borne, for four or five days, or eight at furtheſt. It appears, however, highly imprudent, to venture on ſuch large doſes at once of a medicine ſo very hot and ſtimulating. Boerhaave after recounting, not without ſome exaggeration, its ſtyptic, anodyne, healing, antiſeptic, and diſcutient virtues when applied hot externally, and its aperient, warming, ſudorific and diuretic qualities when taken internally, adds, that it muſt be uſed with great caution; that when taken too freely, it affects the head, excites heat and pain therein, and, violently urging a diabetes, brings on a flux of the ſemen and of the liquor of the proſtates; and that in venereal runnings, in which it has by ſome been commended, it tends to inflame the parts and increaſe the diſorder.

The balſam and the inſpiſſated reſins are uſed chiefly externally: the balſam is leſs pungent than the oil, and the reſins much leſs ſo than the turpentines in ſubſtance. The common yellow reſin, in taſte conſiderably bitter, is ſometimes given as an internal corroborant, in preference to the turpentines themſelves, as being diveſted of the ſtimulating oil.

TURRITIS, tower muſtard, in botany, a genus of plants; the empalement of the flower is compoſed of four oblong oval leaves, which cloſe together. The flower has four oblong, oval, entire petals, placed in form of a croſs, and ſix erect awl-ſhaped ſtamina the length of the tube, two of which are ſhorter than the other, terminated by ſingle ſummits, and a taper germen a little compreſſed, having no ſtyle, but is crowned by an obtuſe ſtigma. The germen afterwards becomes a long four cornered pod with two cells, which are divided by an intermediate partition, opening with two valves, and filled with ſmall, roundiſh, indented ſeed.

Mr. Miller has enumerated three ſpecies of this plant: the firſt ſort grows naturally in ſeveral parts of England upon walls and dry banks; this hath its lower leaves much jagged on their edges, and rough. The ſtalks riſe two feet high, garniſhed with ſmooth greyiſh leaves, ending in points, which embrace the ſtalks with their baſe. The upper part of the ſtalk has ſlender branches, proceeding from the wings of the leaves, which ſuſtain ſpikes of ſmall white flowers, having four petals, placed in form of a croſs. Theſe are ſucceeded by long, ſlender, compreſſed, four cornered pods, which grow erect cloſe to the ſtalk, filled with ſmall ſeeds.

The ſecond ſort grows naturally upon old walls and buildings in the northern counties of England; the lower leaves are ſhaped like thoſe of the daiſy, but rough. The ſtalks riſe eight or ten inches high, garniſhed with oval leaves, whoſe baſes embrace the ſtalks; they are as rough as the lower leaves. The upper part of the ſtalks branch into ſlender ſtalks, which ſuſtain ſhort ſpikes of white flowers, like thoſe of the former ſort, which are ſucceeded by ſlender pods, having four corners ſhorter than thoſe of the firſt ſort.

The third ſort grows naturally in rough ſtony ground about Montpelier. This is much ſmaller than either of the former; the leaves are ſmooth, and all of them entire; the ſtalks are erect, and ſeldom branch; the leaves embrace them with their baſe. The flowers and pods are like the former, but are ſmaller.

Theſe plants are kept in botanic gardens for variety; but if their ſeeds are ſcattered upon an old wall or building in autumn, ſoon after they are ripe, the plants will come up, and thrive without farther care, and their ſeeds will ſcatter on the walls and ſpread, ſo there will be no danger of the plants maintaining their ſituation, if they are not purpoſely deſtroyed.

TURUNDA, in medicine and ſurgery, denotes a tent, pallet, or pencil; or a piece of lint thruſt into a wound, ulcer, &c.

TURTLE, in ichthyology, a name given to ſome ſpecies of the teſtudo, as the hawk's bill turtle is the teſtudo with acuminated ungues, four on the hinder as well as the fore feet; the green turtle, or the teſtudo with two ungues on the fore feet, and one on the hinder; and the long headed turtle, or the great oval headed teſtudo. See TESTUDO.

TURTLE-DOVE, in zoology, a very beautiful little bird of the pigeon kind. The head, neck, and back, are of the bluiſh grey colour of the common pigeon, with ſome mixture of a reddiſh brown near the rump, and at the bottom of the neck. Its breaſt and belly are white; but its throat of a fine bright purple; and the ſides of the neck are variegated with a ſort of ringlet of beautiful white feathers, with black baſes.—It feeds on hempſeed, and other vegetable matters.

TURTLE-SHELL, in natural hiſtory, the name given by the collectors of ſhells to a very beautiful ſpecies of murex, common in the cabinets, but not found any where on the ſhores. This is owing to its having greatly altered its appearance in the poliſhing; for it is no other than the white and brown mouthed murex, which is common in its rough ſtate, with its outer coat taken off.

TUSCAN ORDER, in architecture, the firſt, ſimpleſt, and moſt maſſive of the five orders. See plate XLIII. *fig.* 1.

The Tuſcan order takes its name from an ancient people of Lydia, who coming out of Aſia to people Tuſcany, firſt executed it in ſome temples, which they built in their new plantations.

The Tuſcan is called the Ruſtic order by Vitruvius, and M. de Cambray agrees with him, who in his Parallel, ſays, it never ought to be uſed but in country-houſes and palaces. M. Le Clerc adds, that in the manner Vitruvius, Palladio, and ſome others, have ordered it, it does not deſerve to be uſed at all. But in Vignola's manner of compoſition, he allows it beauty, even in its ſimplicity, and ſuch as makes it proper, not only for private houſes, but even for public buildings, as in the piazzas of ſquares and markets, in the magazines and granaries of cities, and even in the offices and lower apartments of palaces.

The Tuſcan has its character and proportions as well as the other orders; but we have no antient monuments to give us any regular Tuſcan pillar for a ſtandard. M. Perrault obſerves, that the characters of the Tuſcan are nearly the ſame with thoſe of the Doric, and adds, that the Tuſcan is in effect no more than the Doric made ſomewhat ſtronger, by ſhortening the ſhaft of the column; and ſimpler, by the ſmall number, and largeneſs of the mouldings. See DORIC.

Vitruvius makes the whole height of the order fourteen modules, in which he is followed by Vignola, M. Le Clerc, &c. Serlio makes it but twelve. Palladio gives us but one Tuſcan profile, much the ſame as that of Vitruvius, and another too rich, on which ſide Sca-

mozzi is likewiſe too faulty. Hence, it is, that that of Vignola, who has made the order very regular, is moſt followed by the modern architects.

Of all the orders, the Tuſcan is the moſt eaſily executed, as having neither triglyphs nor dentils, nor modillions to cramp its intercolumns. On this account, the columns of this order may be ranged in any of the five manners of Vitruvius, viz. the pycnoſtyle, ſyſtyle, euſtyle, diaſtyle, and araeoſtyle.

TUSCAN *Order by Proportions of equal Parts.* The height of the pedeſtal, being two diameters, is divided into 4, giving 1 to the baſe, whoſe plinth is $\frac{2}{3}$ thereof; the other part is divided into three, giving one to the fillet, and two to the hollow. The breadth of the die or naked is one diameter and $\frac{1}{3}$, andthe projection of the baſe is equal to its height, the fillet hath three-fourths thereof. The height of the corniche is half the baſe, being $\frac{1}{8}$ of the whole height, and is divided into 8, giving 2 to the hollow, 1 to the fillet, and 5 to the band; the projection is equal to the baſe, and the fillet hath three of theſe parts. Baſe of the column: the height is one half a diameter; and is divided into ſix parts, giving three to the plinth, 2 and $\frac{1}{2}$ to the torus, and $\frac{1}{2}$ a part to the fillet; the whole projection is $\frac{1}{3}$ of its height. The hollow, or cincture, is one fourth of a circle, in all the orders, and belongs to the ſhaft of the column.

The diminiſhing of this column is $\frac{1}{4}$ of the diameter, and is divided into 9, giving 2 $\frac{1}{2}$ to the frieze of the capital, $\frac{1}{2}$ a part to the fillet, 3 to the ovolo, and 3 to the abacus. The whole projection is $\frac{1}{8}$ of the diameter, being perpendicular to the body of the column below, and the fillet projects equal to its height. The collerino, or necking of all the orders in general, is one of thoſe nine parts in the capital, and the fillet half a part, the projection is 1 and $\frac{1}{4}$ of theſe parts, and the fillet equal to its height. The height of the entablature being one diameter and $\frac{3}{4}$, is divided into 6, giving 2 to the architrave, 1 $\frac{1}{2}$ to the frieze, and 2 $\frac{1}{2}$ to the corniche.

For the members of the architrave, divide the height into ſeven parts, giving 2 $\frac{1}{2}$ to the firſt face, 3 $\frac{1}{2}$ to the ſecond, and 1 to the band at top. The projection is equal to the band, and the ſecond face a third thereof. The firſt face of all the architraves is perpendicular to the naked of the column at the top. For the corniche, divide the height into 9, giving 1 $\frac{1}{2}$ to the hollow, $\frac{1}{2}$ to the fillet, 1 $\frac{1}{2}$ to the ovolo, 2 to the corona, $\frac{1}{2}$ a part to the fillet, 2 to the ſcima recta, and 1 to the fillet. For the projections, the hollow hath 2 of theſe parts, the ovolo 3 $\frac{1}{2}$, the corona 6, the fillet 6 $\frac{1}{2}$, and the whole 9 being equal to the height. See the figure.

TUSCAN EARTH, a yellowiſh, white, pure bole, conſiderably heavy, of a very ſmooth ſurface, not eaſily breaking between the fingers, but adhering ſlightly to the tongue, and melting very readily in the mouth. It is dug in many parts of Italy, particularly about Florence, where there is a ſtratum of it eight or ten feet thick, at the depth of five or ſix from the ſurface. It is given as a ſudorific, and eſteemed a great medicine in fevers, attended with diarrhœas. See the article BOLES.

TUSCULAN, in matters of literature, a term which frequently occurs in the phraſe *Tuſculan queſtions*. Cicero's Tuſculan Queſtions are diſputations on ſeveral topics in moral philoſophy, which that great author took occaſion to denominate from Tuſculanum, the name of a country-ſeat or villa, where they were compoſed, and where he lays the ſcene of the diſpute. They are compriſed in five books; the firſt on the contempt of death, the ſecond of enduring pain; the third on aſſuaging grief; the fourth on the other pertubations of the mind; and the laſt, to ſhew that virtue is ſufficient to a happy life.

TUSSILAGO, colt's-foot, in botany, a genus of plants, the flower of which has one common cylindrical empalement, whoſe ſcales are linear, ſpear-ſhaped, and equal. The flower is made up of hermaphrodite florets, which compoſe the diſk, and female half-florets, which form the rays or border. The hermaphrodite florets are funnel-ſhaped, cut at the brim into five ſegments; theſe have five ſhort hair-like ſtamina, terminated by cylindrical ſummits, and a ſhort crowned germen, ſupporting a ſlender ſtyle, crowned by a thick ſtigma. The germen afterwards becomes an oblong compreſſed ſeed, crowned with a hairy down. The female half florets are ſtretched out on one ſide with a narrow tongue-ſhaped ſegment; theſe have no ſtamina, but have a ſhort crowned germen, which turns to a ſeed like thoſe of the hermaphrodite florets, which ripen in the empalement.

There are three ſpecies of colt's-foot, the firſt of which is very common in watery places in almoſt every part of England, and is rarely kept in gardens; for the roots creep under ground, and increaſe ſo faſt, that in a ſhort time they will ſpread over a large ſpot of ground.

The ſecond ſort grows naturally in Siberia; this is a very low plant, whoſe leaves grow cloſe to the ground, of an oval form, indented on the ſides like a lute. The flowers ſtand upon ſhort foot-ſtalks, which riſe between the leaves, each ſuſtaining one flower at the top, of a dirty purpliſh colour. Theſe are ſucceeded by downy ſeeds.

The third ſort grows naturally on the Alps; this is a low perennial plant, whoſe leaves are round, indented at the foot-ſtalk in form of a heart; their edges are crenated; their upper ſurface is ſmooth, of a bright green colour; their under ſides are a little downy and whitiſh. The foot-ſtalks of the flowers, which ariſe from the root, ſuſtain one purpliſh flower at the top, which is made up of hermaphrodite and female florets, like thoſe of the other ſorts.

The two laſt are frequently kept in gardens for the ſake of variety; they are eaſily propagated by parting their roots in autumn, and muſt be planted in a moiſt ſhady border, where they will thrive, and require no farther care but to keep them clean from weeds.

The leaves and flowers of colt's-foot, in taſte ſomewhat mucilaginous, bitteriſh, and roughiſh, and of no remarkable ſmell, are ranked among the principal pectoral herbs. Infuſions of them, with a little liquorice, or with the other herbs of ſimilar intention, are drank as tea, and ſometimes with conſiderable benefit, in catarrhous diſorders and coughs threatening conſumptions.

TUTELARY, *Tutelaris*, one who has taken ſomething into his patronage and protection.

It is an ancient opinion, that there are tutelary angels of kingdoms and cities, and even of particular perſons, called Guardian angels.

The ancient Romans, it is certain, had their tutelary gods, whom they called *Penates*. — And the Romiſh church to this day, hold an opinion not much unlike it: they believe that every perſon, at leaſt every one of the faithful, has, from the time of his birth, one of thoſe tutelary angels attached to his perſon, to defend him from all temptations; and it is on this, principally, that their practice of invoking angels is founded.

F. Anthony Macedo, a Portugueſe Jeſuit of Coimbra, has publiſhed a large work in folio, on the tutelary ſaints of all the kingdoms, provinces, and great cities of the Chriſtian world, *divi tutelares orbis chriſtiani*, at Liſbon, 1678.

TUTOR, in the civil law, is one choſen to look to the perſon and eſtate of children left by their fathers and mothers in their minority. A perſon nominated tutor either by teſtament, or by the relations of the minor, is to decline that office if he have five children alive, if he have any other conſiderable tutorage, if he be under twenty-five years of age, if he be a prieſt, or a regent in an univerſity, or if he have any law-ſuit with the minors, &c. The marriage of a pupil, without the conſent of his tutor, is invalid. Tutors may do any thing for their pupils, but nothing againſt them; and the ſame laws which put them under a neceſſity of preſerving the intereſt of the minors, put them under an incapacity of hurting them.

TUTOR, is alſo uſed in our univerſities for a member of ſome college or hall, who takes on him the inſtruction of ſome young ſtudents in the arts or faculties.

TUTORAGE, *Tutela*, in the civil law, a term equivalent to guardianſhip in the common law, ſignifying

an office impoſed on any one to take care of the effects of one or more minors.

By the Roman law, there are three kinds of tutorage; teſtamentary, which is appointed by the father's teſtament; legal, which is given by the law to the neareſt relation; and dative, which is appointed by the magiſtrate. But in all cuſtomary provinces, as France, &c. all tutorages are dative and elective, and though the father have by teſtament nominated the next relation to his pupil, yet is not that nomination of any force, unleſs the choice be confirmed by that of the magiſtrate, &c. By the Roman law, tutorage expires at fourteen years of age.

TUTTY, *Tutia*, an argillaceous ore of zinc, found in Perſia; formed on cylindrical moulds into tubulous pieces like the bark of a tree, and baked to a moderate hardneſs; generally of a browniſh colour, and full of ſmall protuberances on the outſide, ſmooth and yellowiſh within, ſometimes whitiſh, and ſometimes with a bluiſh caſt. Like other argillaceous bodies, it becomes harder in a ſtronger fire; and after the zinc has been revived and diſſipated by inflammable additions, or extracted by acids, the remaining earthy matter affords, with oil of vitriol, an aluminous ſalt.

Tutty, levigated into an impalpable powder, is, like the lapis calaminaris and calces of zinc, an uſeful ophthalmic, and frequently uſed as ſuch in ointments and collyria. Ointments for this intention are prepared in the ſhops, by mixing the levigated tutty with ſo much vipers fat as is ſufficient to deduce it to a due conſiſtence, or by ſprinkling half an ounce of the powder into two ounces of freſh butter and a dram of white wax liquefied together, to which is occaſionally added a dram or two of camphor.

TWELFTH-DAY, or TWELFTH-TIDE, the feſtival of the Epiphany, or the manifeſtation of Chriſt to the Gentiles; ſo called, as being the twelfth day, excluſive, from the Nativity or Chriſtmas-day.

TWELVE MEN, otherwiſe called jury, or inqueſt, is a number of twelve perſons, or upwards as far as twenty-four; by whoſe oath, as to matters of fact, all trials paſs, both in civil and criminal caſes, through all courts of the common law in this realm. See JURY and TRIAL.

TWILIGHT, *Crepuſculum*, that light, whether in the morning before ſun-riſe, or in the evening after ſun-ſet, ſuppoſed to begin and end when the leaſt ſtars that can be ſeen by the naked eye ceaſe, or begin, to appear, repreſented in plate CXXXIV. *fig.* 2. by that obſcure part comprehended between H O A B, which is neither dark nor light. This is the twilight, the line A B being 18° below the horizon H O; and during the time the ſun paſſeth from H O to A B, in the parallel of any day, his rays are partly refracted by the atmoſphere, and ſo we have ſome faint light till he gets below the limit A B, when we are left in total darkneſs. Or it is twilight, while the ſun is paſſing from X to R, from Y to S, and from Z to M, on the days the ſun deſcribes the parallels T R, Æ Q, and V W. By means of the atmoſphere it happens, that though none of the ſun's direct rays can come to us after it is ſet, yet we ſtill enjoy its reflected light for ſome time, and night approaches by degrees. For after the ſun is hid from our eyes, the upper part of our atmoſphere remains for ſome time expoſed to its rays, and from thence the whole is illuminated by reflection. But as the ſun grows lower and lower, that portion of the atmoſphere which is above our horizon, becomes enlightened till the ſun has got eighteen degrees below it; after which it ceaſes to be illuminated thereby, till it has got within as many degrees of the eaſtern ſide of the horizon; at which time it begins to illuminate the atmoſphere again, and in appearance to diffuſe its light throughout the heavens, which continues to increaſe till the ſun be up.

Hence it is, that during that part of the year in which the ſun is never eighteen degrees below our horizon, there is a continued twilight from ſun-ſetting to ſun-riſing. Now that part of the year in the latitude of London, is while the ſun is paſſing from about the fifth degree of Gemini to the twelfth of Cancer; that is, from about the 26th of May to the 18th of July: for when the ſun deſcribes the parallel T R, that is, the tropic of Cancer, there is no dark night at all; for the parallel of that day, T R, doth not touch A B, nor will it for about a month before and after. On the other hand, the ſhorteſt twilight in the year happens about the 14th of October and 4th of March, for then the ſun deſcribes the parallel whoſe diſtance *e o* is the leaſt between H O and A B of any other whatſoever.

As the twilight depends on the quantity of matter in the atmoſphere fit to reflect the ſun's rays, and alſo on the height of it, for the higher the atmoſphere is, the longer will it be, before the upper parts of it will ceaſe to be illuminated, the duration of it will be various. For inſtance, in winter, when the air is condenſed with cold, and the atmoſphere upon that account lower, the twilight will be ſhorter; and in ſummer, when the limits of the atmoſphere are extended by the rarefaction and dilatation of the air, of which it conſiſts, the duration of the twilight will be greater. And for the like reaſon, the morning twilight, the air being at that time condenſed and contracted by the cold of the preceding night, will be ſhorter than the evening one, when the air is more dilated and expanded.

TWINS, two young ones delivered at a birth, by an animal which ordinarily brings forth but one.

TWINS, in aſtronomy, the ſame with Gemini. See the article GEMINI.

TWIST *of a rope, cord*, &c. See ROPE, &c.

TWIST is alſo uſed for the inſide or flat part of a man's thigh, upon which a true horſeman reſts when on horſeback.

To TWIST *an horſe*, is violently to wring or twiſt his teſticles twice about, which cauſes them to dry up, and deprives them of nouriſhment, and reduces the horſe to the ſame ſtate of impotency with a gelding.

TYCHONIC SYSTEM, or HYPOTHESIS, an order or arrangement of the heavenly bodies, of an intermediate nature between the Copernican and Ptolemaic, or participating alike of them both.

This ſyſtem had its name and original from Tycho Brahe, a nobleman of Denmark, who lived in the latter part of the laſt century. This philoſopher, though he approved of the Copernican ſyſtem, yet could not reconcile himſelf to the motion of the earth; and being on the other hand convinced the Ptolemaic ſcheme could not be true, he contrived one different from either, as repreſented plate CXXV. *fig.* 2. In this the earth has no motion allowed it, but the annual and diurnal phænomena are ſolved by the motion of the ſun about the earth, as in the Ptolemaic ſcheme; and thoſe of Mercury and Venus are ſolved by this contrivance, though not in the ſame manner, nor ſo ſimply and naturally as in the Copernican ſyſtem. The Tychonic ſyſtem then ſuppoſed the earth in the center of the world, that is, of the firmament of ſtars, and alſo of the orbits of the ſun and moon; but at the ſame time it made the ſun the center of the planetary motions, viz. of the orbits of Mercury, Venus, Mars, Jupiter, and Saturn. Thus the ſun, with all its planets, was made to revolve about the earth once a year, to ſolve the phænomena ariſing from the annual motion, and every twenty-four hours, to account for thoſe of the diurnal motion. But this hypotheſis is ſo monſtrouſly abſurd, and contrary to the great ſimplicity of nature, and, in ſome reſpects, even contradictory to appearances, that it obtained but little credit, and ſoon gave way to the Copernican ſyſtem.

After this ſcheme had been propoſed for ſome time, it received a correction by allowing the earth a motion about its axis to account for the diurnal phænomena of the heavens; and ſo this came to be called the Semi-tychonic ſyſtem. But this was ſtill void of the truth, and encumbered with ſuch hypotheſis, as the true mathematician and the genuine philoſopher could never reliſh.

TYGER, or TIGER, in zoology. See the article TIGER.

TYLE, or TILE, in building, a ſort of thin, fictitious, laminated brick, uſed on the roofs of houſes; or more properly a kind of fat clayey earth, kneaded and moulded, of a juſt thickneſs, dried and burnt in a kiln like a brick, and uſed in the covering and paving of houſes. See BRICK.

Tubes

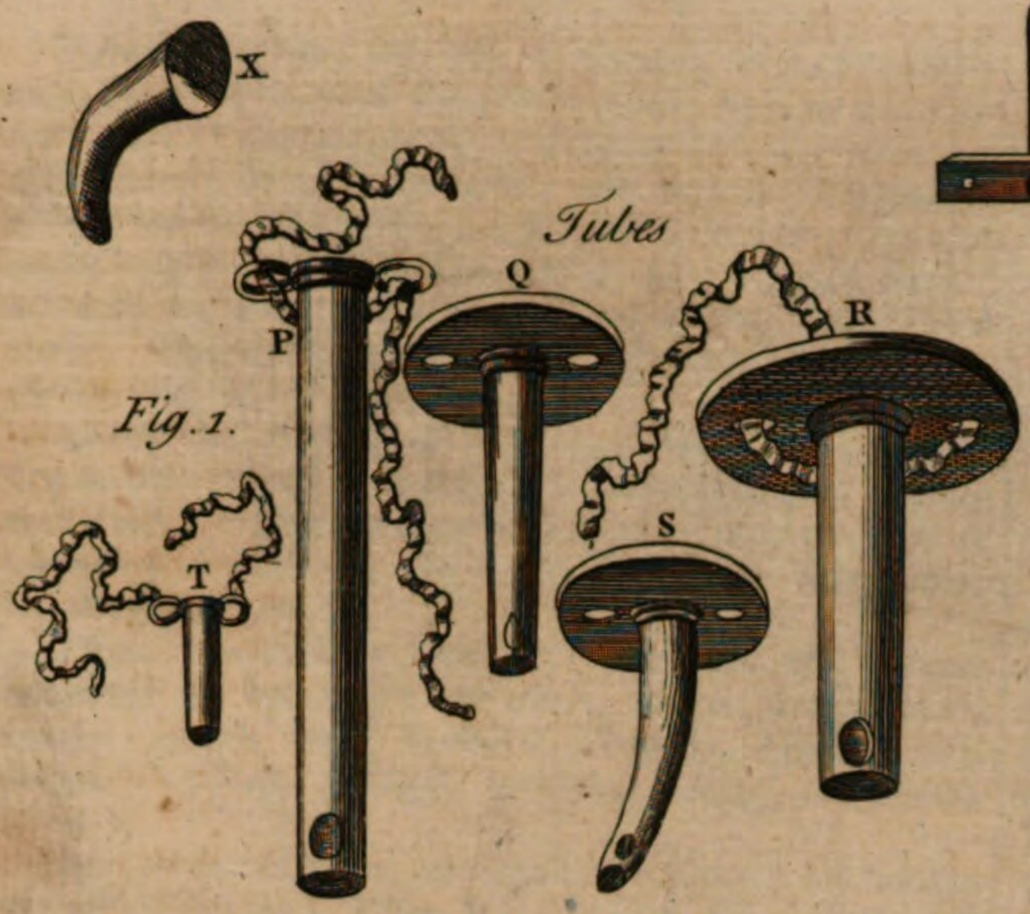
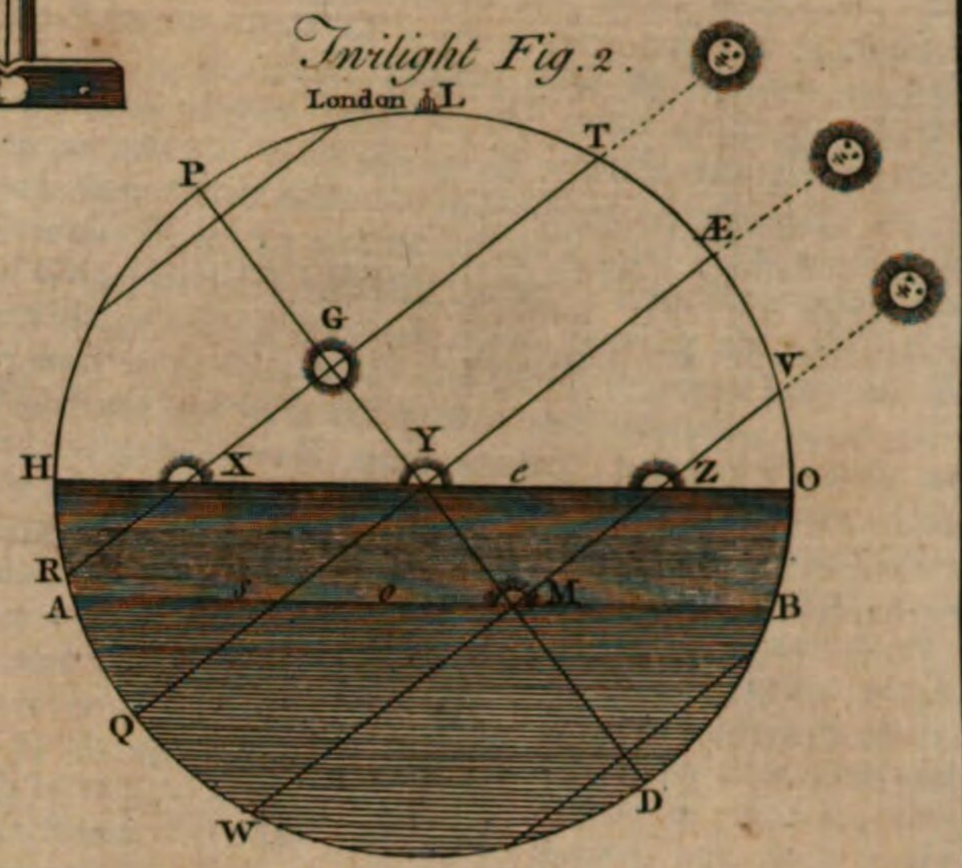


Fig. 1.

Twilight Fig. 2.



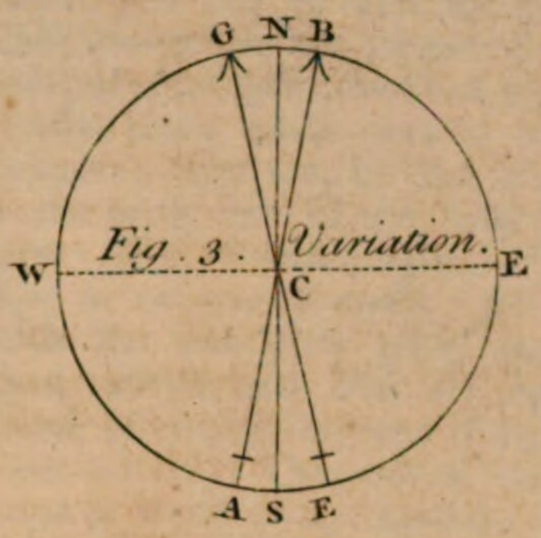
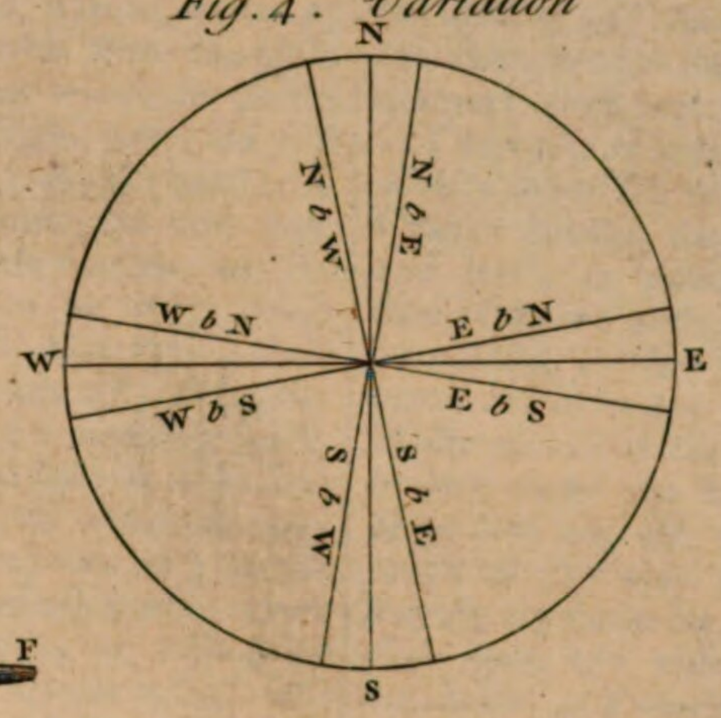


Fig. 3. Variation.

Fig. 4. Variation



Ventilators

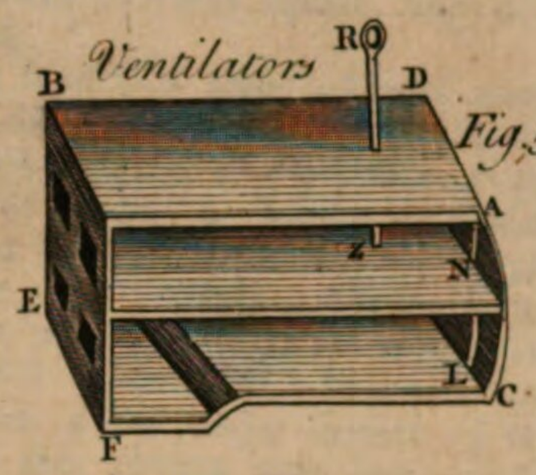
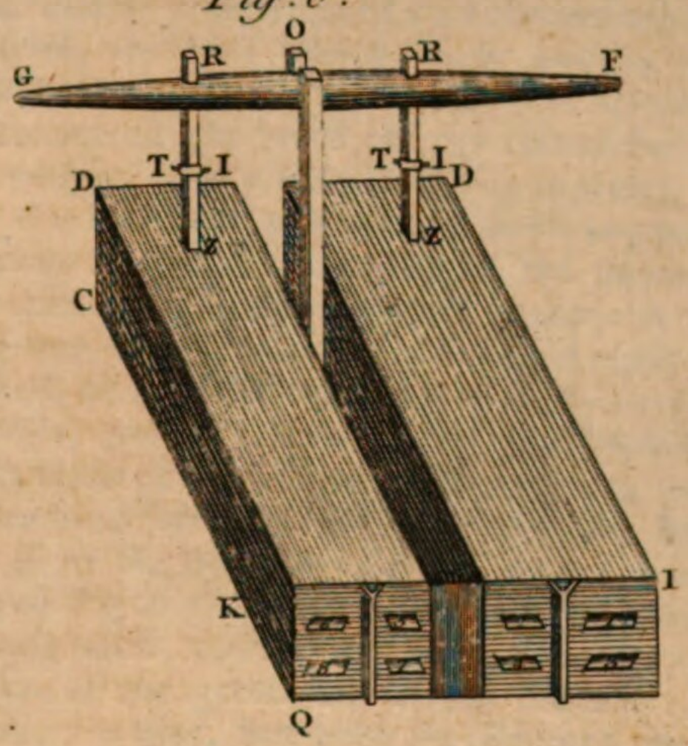


Fig. 5.

Fig. 6.



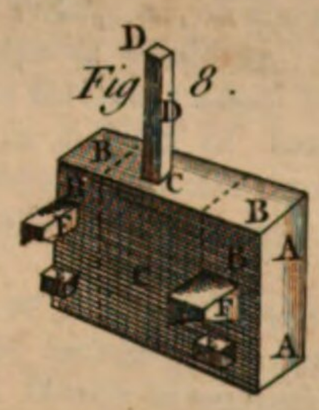
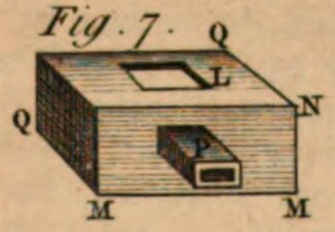


Fig. 8.

Fig. 7.



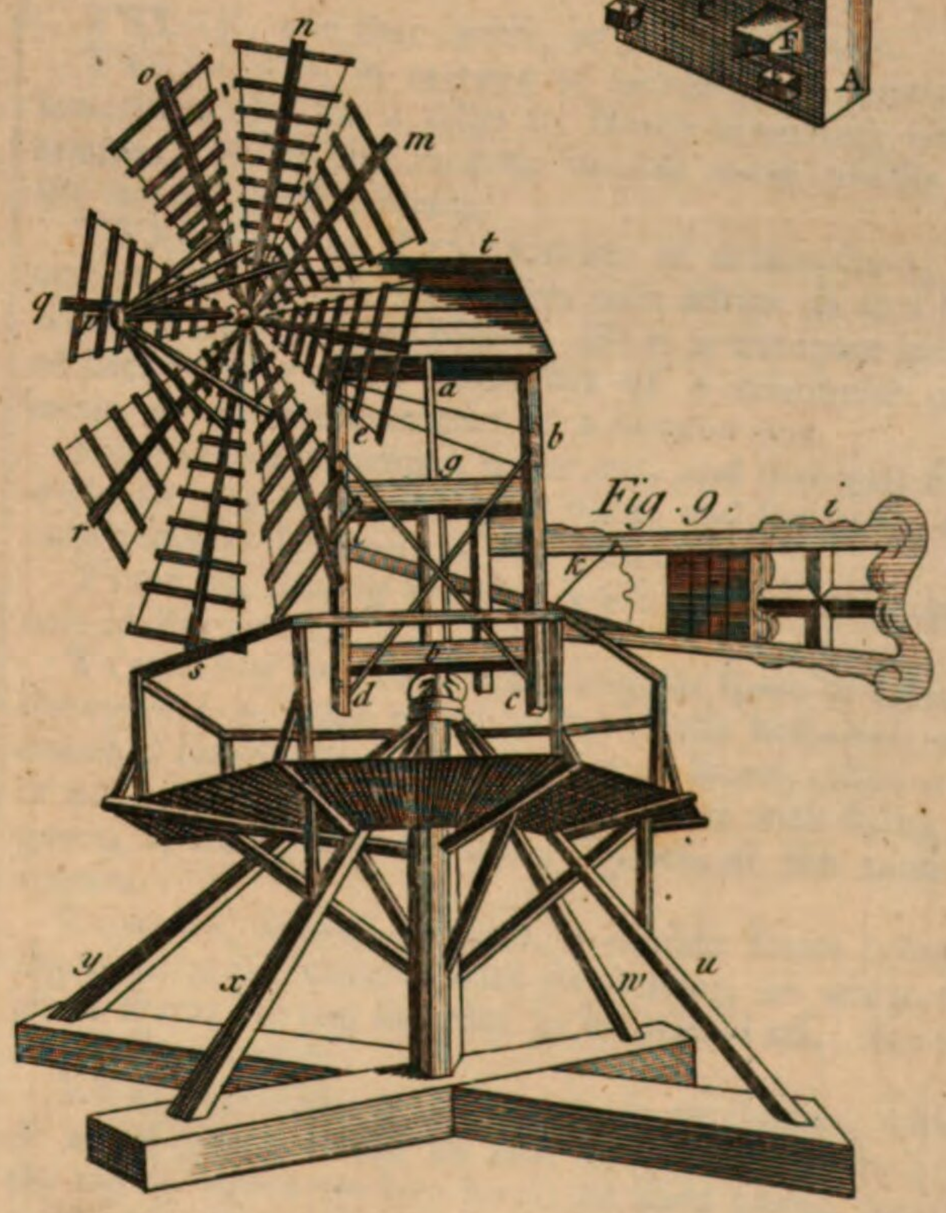


Fig. 9.

Fig. 10.

Tyles are made, ſays Mr. Leybourn, of better earth than brick-earth, and ſomething nearer akin to the potter's earth. According to 17 Edward IV. the earth for tyles ſhould be caſt up before the firſt of November, ſtirred and turned before the firſt of February, and not made into tyles before the firſt of March; and ſhould likewiſe be tried and ſevered from ſtones, marle, and chalk. For the method of burning them, ſee the article BRICK.

As to the method of applying tyles, ſome lay them dry as they come from the kiln, without mortar or any thing elſe; others lay them in a kind of mortar made of loam and horſedung. In ſome parts, as in Kent, they lay them in moſs.

There are various kinds of tyles, for the various occaſions of building; as plain, thack, ridge, roof, creaſe, gutter, pan, crooked, Flemiſh, corner, hip, dormar, ſcallop, aſtragal, traverſe, paving, and Dutch tyles.

Plain or thack tyles, are thoſe in ordinary uſe for covering of houſes. They are ſqueezed flat, while yet ſoft, in a mould. They are of an oblong figure, and by 17 Ed. IV. c. 4. are to be 10 $\frac{1}{2}$ inches long, and 6 $\frac{1}{4}$ broad, and half an inch and half a quarter thick. But theſe dimenſions are not over ſtrictly kept to. Ridge, roof, or creaſe tyles, are thoſe uſed to cover the ridges of houſes, being made circular breadth-wiſe, like an half cylinder: they are, by the aforeſaid ſtatute, to be 13 inches long, and of the ſame thickneſs with the plain tyles. Hip or corner tyles, are thoſe which lie on the hips or corners of roofs. As to form, they are firſt made flat like plain tyles, but of a quadrangular figure, whoſe two ſides are right lines and two ends arches of circles, one end being a little concave and the other convex. The convex end is to be about ſeven times as broad as the concave end, ſo that they would be triangular but that one corner is taken off; then, before they are burnt, they are bent on a mould breadth-wiſe, like ridge tyles. They have an hole at their narrow end to nail them on by, and are laid with their narrow end upwards; by ſtatute they are to be 10 $\frac{1}{2}$ inches long, and of a convenient breadth and thickneſs. Gutter-tyles, are thoſe which lie in gutters or valleys in croſs buildings. They are made like corner tyles, only the corners of the broad end are turned back again with two wings. They have no holes in them, but are laid with the broad end upwards, without any nailing. They are made in the ſame mould as the corner tyles, and have the ſame dimenſions on the convex ſide. Their wings are each four inches broad, and eight long. Pan, crooked, or Flemiſh tyles, are uſed in covering of ſheds, lean to's, and all kinds of flat roof buildings. They are in form of an oblong parallelogram, as plain tyles, but are bent breadth-wiſe forwards and backwards in form of an S, only one of the arches is at leaſt three times as big as the other; which biggeſt arch is always laid uppermoſt, and the leſs arch of another tyle lies over the edge of the great arch of the former. They have no holes for pins, but hang on the laths by a knot of their own earth. They are uſually 14 $\frac{1}{2}$ inches long, and 10 $\frac{1}{2}$ broad. By 12 Geo. I. c. 25. they are to be, when burnt, not leſs than 13 $\frac{1}{2}$ inches long, and 9 $\frac{1}{2}$ inches wide, and half an inch thick. Dormar or dorman tyles conſiſt of a plain tyle and a triangular piece of a plain one ſtanding up at right angles to one ſide of the plain tyle, and ſwept with an arch of a circle from the other end, which end terminates in a point. Of theſe tyles there are two kinds, the triangular piece in ſome ſtanding on the right, in others on the left ſide of the plain tyle. And of theſe again there are two kinds, ſome having a plain whole tyle, others but half a plain tyle. But in them all the plain tyle has two holes for the pins at that end where the broad end of the triangular piece ſtands. Their uſe is to be laid in the gutters betwixt the roof and the cheeks or ſides of the dormars, the plain part lying on the roof, and the triangular part ſtanding perpendicularly by the cheek of the dormar; they are excellent to keep out the wet in thoſe places, and yet they are hardly known any where but in Suſſex. The dimenſions of the plain tyle part, are the ſame as thoſe of a plain tile, and the triangular part is of the ſame length, and its breadth at one end ſeven inches, and at the other nothing. Scallop or aſtragal tyles are in all reſpects like plain tyles, only their lower ends are in form of an aſtragal, viz. a ſemi-circle with a ſquare on each ſide. They are uſed in ſome places for weather tyling. Tranſverſe tyles, are a kind of irregular plain tyles, having the pin holes broken out, or one of the lower corners broken off. Theſe are laid with the broken end upwards, upon rafters where pinned tyles cannot hang. Flemiſh or Dutch tyles are of two kinds, ancient and modern. The antient were uſed for chimney foot-paces; they were painted with antique figures, and frequently with poſtures of ſoldiers, ſome with compartments, and ſometimes with moreſque devices; but they come much ſhort of the deſign and colours of the modern ones. The modern Flemiſh tyles are commonly uſed plaſtered up in the jaumbs of chimneys inſtead of chimney-corner ſtones. Theſe are better glazed, and ſuch as are painted, for ſome are only white, are done with more curious figures and more lively colours than the ancient ones. But both kinds ſeem to be made of the ſame whitiſh clay as our white glazed earthen ware; the modern ones are commonly painted with birds, flowers, &c. The ancient ones are only five inches and a quarter ſquare, and about three quarters of an inch thick; the modern ones ſix inches and a half ſquare, and three quarters of an inch thick.

TYLE, in aſſaying, a ſmall flat piece of dried earth uſed to cover the veſſels in which metals are in fuſion. Cramer directs, that theſe be made of a mixture of clay and ſand, or powder of flints, or broken crucibles, formed into a paſte, and ſpread thin with a rolling pin on a table, or flat ſtone. From theſe cakes or plates, pieces are to be cut with a knife, to the ſhape and ſize of the mouth of the veſſels to be cloſed. It is beſt then to pare away the borders of the under ſurface of the piece thus cut off, that this ſurface may immediately touch all the way the edge of the mouth of the veſſel, leaving a prominent rim, by which means the tyle ſits cloſe upon the veſſel, and is not ſo eaſily diſplaced by accidents, as a touch of the poker, or of the coals put on to mend the fire, as it otherwiſe would be. Finally, put on the middle of the outer ſurface a ſmall bit of the ſame matter, which ſerves as a kind of handle, by means of which it may be conveniently managed by the tongs, and eaſily taken off and put on again at pleaſure.

TYLER, one that covers, or paves with tyles.

TYLWITH, in matters of heraldry and deſcent, is ſometimes uſed for a tribe or family branching out of another, which the modern heralds more uſually call the ſecond or third houſe.

TYMPAN, or TYMPANUM, in architecture, the area of a pediment, being that part which is in a level with the naked of the frieze. Or it is the ſpace included between the three corniches of a triangular pediment, or the two corniches of a circular one.

Sometimes the tympan is cut out, and that part filled with an iron lattice to give light, and ſometimes it is enriched with ſculpture in baſs-relievo.

TYMPAN, among joiners, is alſo applied to the pannels of the doors.

TYMPAN *of an Arch*, is a triangular ſpace or table in the corners or ſides of an arch, uſually hollowed, and enriched ſometimes with branches of laurel, olive-tree, or oak, or with trophies, &c. ſometimes with flying figures, as Fame, &c. or ſitting figures, as the cardinal virtues.

TYMPAN, among printers, a double frame belonging to the preſs, covered with parchment, on which the blank ſheets are laid in order to be printed off. See the article PRINTING.

TYMPANUM, or TYMPAN, in mechanics, a kind of wheel placed round an axis or cylindrical beam; on the top of which are two levers or fixed ſtaves, for the more eaſy turning the axis, in order to raiſe a weight required.

quired. The tympanum is much the ſame with the peritrochium, but that the cylinder of the axis of the peritrochium is much ſhorter, and leſs than the cylinder of the tympanum.

TYMPANUM *of a Machine*, is alſo uſed for an hollow wheel, wherein one or more people, or other animals, walk to turn it; ſuch as that of ſome cranes, calenders, &c.

TYMPANUM, a drum. See DRUM.

TYMPANUM, in anatomy, the middle part of the ear. See EAR.

TYMPANY, *Tympanites*, in medicine, a flatulent tumour or ſwelling of the abdomen or belly, very hard, equable and permanent, whereby the ſkin is ſtretched ſo tight, that when ſtruck it gives a ſound like that of a drum. Hoffman obſerves that this diſeaſe has been generally accounted, both by the antients and moderns, a ſpecies of dropſy, but very improperly; for though it is often productive of, or complicated with an aſcites, yet it is in itſelf a perfectly diſtinct diſeaſe, and accompanied with no extravaſation of water in the abdomen; perſons who have died of it having been found, on opening the body, with the abdomen as dry as in a ſtate of health; but the ſtomach has been found, in ſome, greatly diſtended with flatulencies, and containing a viſcid humour, though in no great quantity. The inteſtines are alſo uſually found diſtended, and, as it were, pellucid, and, on being pricked, they collapſe, without the appearance of any water. And, in ſome caſes, on opening the abdomen, the whole ſwelling has ſubſided, on the excluſion of a groſs flatulence which had diſtended it. The inteſtines have, in ſome ſubjects, been found diſtended to the bigneſs of a man's thigh, in ſome parts; and in others, lower down, ſo contorted and twiſted together, that there could be no paſſage either for the wind or the excrements. It is not uncommon alſo, on diſſection, to find great numbers of worms, of the common long kind, in the inteſtines.

A tympany, without a dropſy, is moſt incident to women after labour, when the lochia have been ſuppreſſed by colds or otherwiſe, or diſcharged in too ſmall quantities; a bad regimen during the lying in, and the omitting to ſwathe the belly properly down, has alſo often a bad effect this way. In caſes of this kind, women find ſoon afterwards the abdomen inflated, with a conſiderable uneaſineſs, a difficulty of breathing, coſtiveneſs, and an unaccountable anxiety. Theſe are the breeding ſymptoms of the approaching tympany; and the ſame often happens after unſkilful treatment in abortions, and after the leaving a part of the lochia behind, or the injuring the uterus in delivery.

Children are alſo ſubject to tympanies, when violently afflicted with worms, and ſometimes after the meaſles and ſmall-pox; and if due care is not taken of theſe caſes, at their beginning, the ſuperior parts ſoon become extenuated, and the patients die. Extreme voracity of children alſo, and their eating great quantities of food, at a time when the ſtomach is weak, ſometimes brings on this diſorder.

The tympany is juſtly accounted one of the more dangerous kinds of diſeaſes, ſince the perſons afflicted with it much oftener die than recover. When it is accompanied with a dropſy, it is ſcarce ever cured; and a ſimple tympany in women and children, if neglected at firſt, degenerates into a chronic diſorder, and hardly admits of a cure. Some, indeed, have gone ſo far as to ſay, they never knew a patient, afflicted with a tympany, recover; but this ſeems too raſh a judgment. That diſtenſion of the abdomen, which is properly called a flatulent colic, is by ſome accounted a ſpecies of tympany; but this is not naturally dangerous, and is eaſily cured, except when it is attended with ſpaſms of the viſcera; in which caſe the medicines given to reſtore the due tone of the inteſtines, are by no means proper in regard to the ſpaſms.

In curing flatulences of the ſtomach and inteſtines, the phyſician's principal intention is to promote a diſcharge of the vapours by the anus, and to attenuate and gently carry off, by ſtool, the tough and viſcid matter, which contributes to the generation of the flatulences. For this purpoſe, firſt derivative, diſcutient, and evacuating clyſters are to be uſed, ſuch as thoſe prepared of hyſſop, clary, flowers of common and roman chamomile, tops of yarrow, juniper-berries, and the larger carminative ſeeds, with veal broth, adding a ſufficient quantity of ſal gemmæ, ſal ammoniac, or Epſom ſalt, and the oil of chamomile. But it is to be obſerved, that one or two clyſters are not ſufficient for removing the diſorder, but they are to be frequently repeated. With theſe are to be interpoſed laxatives, poſſeſſed of a carminative, and, at the ſame time, ſomewhat of an anodyne quality. Or, if the patient is ſtrong, and the inflation a real tympanites, two parts of the extractum panchymagogum Crollii, with one part of the pilulæ Wildeganſi, or of the pilulæ Starckii, or pilulæ de ſtyrace, in ſome very ſpirituous carminative water, is to be exhibited.

After theſe are to be uſed medicines poſſeſſed of a moderate balſamic principle, and a volatile, oleous, and aromatic ſalt, commonly called carminatives; but the operation of theſe medicines is not to be ſo explained, as if by their ſubtile volatile ſalt they attenuate the matter of the flatulences and rendered it thinner; but rather, becauſe, by invigorating the tone and ſyſtole of the inteſtinal coats, they hinder the ſtagnation of the flatulences, move them from their ſeat, and render them more capable of being eaſily eliminated, or prevent the generation of new flatulences; for, as the deſtroyed periſtaltic motion of the ſtomach and inteſtines is the principal cauſe of flatulences, ſo all the medicines which have a remarkable virtue in ſtrengthening theſe parts, are moſt proper for the removal of this diſorder. The beſt and moſt approved of this kind, are powders prepared of the roots of wake-robin, zedoary, and white burnet; the digeſtive ſalt of ſylvius, or vitriolated tartar; cumin ſeeds, the tops of the leſſer centaury, and dried orange peel, each a dram, and ſix drops of the genuine oil of chamomile; or of the oil of cedar, or of the oil of orange peel; to which if there is a ſuſpicion of an acid lodged in the primæ viæ, we may commodiouſly add crabs eyes.

To this claſs of medicines may be referred the following liquid form: take of the carminative water of Dorncrellius, of the waters of common chamomile and zedoary prepared with wine, each one ounce; of the ſpiritus nitri dulcis, of the pure oil of carraway, eight drops mixed with two drams of ſugar.

Nor are external remedies, ſuch as linimenta applied by way of ointment to the whole epigaſtric region, to be neglected. The principal ingredients of theſe liniments ought to be boiled with oils of chamomile and rue, oil of nutmeg and Peruvian balſam, with which may be mixed the oils of juniper, carraway, aniſe, or cumins. But preferable to all others, the liquid balſam of life may be uſed, which when mixed with three parts of Hungary water, and applied by way of ointment to the abdomen, or laid on with a warm linen cloth, is found of great efficacy.

TYPE, *Typus*, a copy, image, or reſemblance of ſome model.

The word is formed from the Greek, τυπος, form, figure.

The term type is leſs in uſe than its compounds prototype and archetype, which are the originals that are made without models.

TYPE, is alſo a ſcholaſtic term much uſed among divines, ſignifying a ſymbol, ſign, or figure of ſomething to come.

In this ſenſe, the word is commonly uſed with relation to antitype, ανπιτυπον, which is the thing itſelf, of which the other is a type or figure.

Thus, Abraham's ſacrifice, the paſchal lamb, &c. were types or figures of our redemption: and the brazen ſerpent was a type of the croſs, &c.

Types are not mere conformities, or analogies, which the nature of things holds forth between them; nor arbitrary images ariſing merely from the caſual reſemblance of things; but there is further required a particular inſtitution of God to make a type; and a particular declaration of his that it is ſo.

Gale divides types into hiſtorical and prophetical. The firſt are thoſe uſed by the ancient prophets in their agitations and viſions: the ſecond thoſe wherein things done, or ceremonies inſtituted in the Old Teſtament, prefigure Chriſt, or things relating to him in the New Teſtament.

The ancient fathers, as well as the modern critics, have been greatly divided about the nature and uſe of types, and typical repreſentations, in the Old Teſtament; and it is this makes one of the great difficulties in underſtanding the ancient prophecies, and in reconciling the New and Old Teſtament together.

There is no denying but that there were ſome types which the Divine Wiſdom inſtituted to be the ſhadows and figures of things to come: and yet people run into an exceſs that way; ſome looking for types in every thing; like Origen, who diſcovered myſteries in the very caldrons of the tabernacle. A prudent man ſhould be contented with the more ſenſible and obvious ones; nor propoſe any without proving them as much as poſſible, and ſhewing that they were really intended for types, in order to juſtify the ſolidity of the reaſoning of the apoſtles, who argued from them.

A late author maintains, that not the fathers only, but St. Paul himſelf, was of opinion, that, "Chriſtianity was all contained in the Old Teſtament, and was implied in the Jewiſh hiſtory and law; both which are to be reputed types and ſhadows of Chriſtianity." In order to which, he quotes Hebrews viii. 5. x. 1. and Coloſ. ii. 16, 17.—He adds, "That the ritual laws of Moſes, being in their own nature no other than types and ſhadows of future good things, are to be conſidered as having the effect of prophecies."—This is likewiſe the ſenſe of Mr. Whiſton, and others; but the ſame author even quotes our Saviour ſpeaking in behalf of this typical reaſoning, in that paſſage Matth. xi. 13. where he affirms, that "The law propheſies; and that he came to fulfil the law as well as the goſpel."

An ingenious divine takes this occaſion to obſerve, that had the ancients, with the modern retainers to the typical way, expreſsly deſigned to have expoſed Chriſtianity, they could not have done it more effectually than by thus making every thing types and prophecies.—It is no wonder, he adds, that atheiſts and deiſts ſcoff at the credulity of Chriſtians, and reject what is ſupported by ſuch folly and abſurdity.

Not that he denies the reality of ſuch things as types. It is manifeſt, there were many under the Old Teſtament; ſuch were Zachariah's ſtaves, beauty, and bands, ch. xi. 7, 10, 14. ſuch was Hoſea's adulterous wife ch. i. 2; and ſuch were his children, ver. 4, 6.—The prophets deſigned by theſe to prefigure future events; but in theſe inſtances the reader is at once, by the declaration of the prophet, made to underſtand as much, and not left to his own conjectures about them, after the events are over.

In effect, all that is urged from ſcripture for the typical or allegorical interpretations of the Jewiſh law, hiſtory, ceremonies, &c. it is aſſerted, may be ſet aſide without any violence to the ſacred text, which may be explained on more natural and intelligible principles, and more conſiſtently with grammar.

The word type we have obſerved, literally denotes no more than a copy or impreſſion of any thing; and accordingly, in our tranſlation, we find it ſometimes rendered by print, ſometimes by figure, ſometimes by faſhion, and ſometimes by form.—Hence alſo the word is figuratively applied to denote a moral pattern; in which ſenſe it ſignifies no more than example and ſimilitude.

Again the word antitype, in ſcripture, ſignifies any thing formed according to a model or pattern; and thus in the Epiſtle to the Hebrews, the tabernacle, and holy of holies being made according to the pattern ſhewn to Moſes, are ſaid to be antitypes or figures of the true holy places.—In the like ſenſe St. Peter ſpeaking of the flood and the ark, whereby eight perſons were ſaved, calls baptiſm an antitype thereto; by which he expreſſes no more than a ſimilitude of circumſtances. The other words uſed in ſcripture to imply a future event, prefigured by ſome foregoing act, are—ὑποδειγμα, rendered by imitation and example; and σκια, ſhadow.

This laſt word is frequently uſed by St. Paul, and applied to the Jewiſh law, ceremonies, prieſts, &c. which are repreſented as only ſhadows of things to come, or of heavenly things. It is from ſuch general expreſſions, that people were led to miſtake the apoſtle's deſign in theſe compariſons, and to aſſert, that all the Moſaic rites were types of, or deſigned to ſignify future events; aud that the goſpel is to be found in the pentateuch.—Whereas St. Paul's intent appears no other than to ſhew the great advantage of the goſpel over the law in ſeveral particulars, wherein it has much preeminence as the ſubſtance has over the ſhadow.

If the ſhadow of things to come ſignify a prefiguration of future events, what are thoſe events to which the Jewiſh new moons, Col. ii. 16. or the Jewiſh meats and drinks, have a reſpect? Or, how did the law of Moſes, made of commands about perſons, times, places, and ſacrifices, prefigure a diſpenſation where regard to ſacrifices, holy perſons, times and places are ſo far from being enjoined, that they are declared uſeleſs. Can a particular holy place in the law be deſigned a prefiguration of a ſtate where all places are equally holy?

Such being the import of all the terms uſed in the New Teſtament writers, ſeeming to imply any prefiguration of future events under the goſpel, we may obſerve, 1. That to argue from types, is only to argue from examples or ſimilitudes; and, conſequently, that all inferences drawn from ſuch reaſonings, are no farther concluſive, than reaſonings from ſimilitudes are.—The intent of ſimilitudes is only to help to convey ſome ideas more clearly or ſtrongly; ſo that to deduce conſequences from ſimile, or infer any thing from other parts of the ſimile than what are plainly ſimilar, is abſurd.

2. It cannot be proved that the ceremonies of the Moſaic law were even deſigned to prefigure any future events in the ſtate of the Meſſiah's kingdom.—No ſuch declared prefigurations are mentioned in the writings of the Old Teſtament, whatever notions prevailed among the writers who immediately followed. It is granted, that the apoſtles argued from the rites in the Moſaic inſtitution; but this appears to have only been by way of illuſtration and analogy.

There is certainly a general likeneſs in all the diſpenſations of Providence; an analogy of things in the natural as well as the moral world, from which it is eaſy arguing by way of parity, and it is very juſt and uſual ſo to do; but that one of theſe diſpenſations was therefore given to prefignify another that was future, can never be proved, unleſs it be expreſsly declared.—The Land of Promiſe, we know, was to be a place where the Jews were to enjoy reſt from their labours; God likewiſe, did, himſelf, reſt the ſeventh day from his works: yet, whoever imagined God's reſt from the creation to be prefigurative of the Jews reſt in Canaan? and it is not equally reaſonable to ſay, that God's reſt on the ſeventh day, prefigured the entrance of the Jews into Canaan, as to ſay, that the Jews reſt in Canaan prefigured the reſt mentioned by David in the Pſalms.

This will equally imply, that all the following events in the uniform courſe of God's government, ſimilar to any preceding ones, were deſigned to be prefigured by them; in which ſenſe, it will readily be owned, that the reſt of the Jews was typical of the reſt of the Chriſtians.

It is in the ſame manner we are to underſtand St. Paul, where he ſay's, "That Chriſt our paſſover is ſacrificed for us." And thus we are to underſtand John the Baptiſt, when he calls our Saviour the "Lamb of God."—There was this ſimilitude of circumſtance, that Chriſt was ſlain on the ſame day with the paſchal lamb; that he died about the ſame time of the day when the prieſts began their lullel; that not a bone of the one or the other was broken. Add, that as the paſchal lamb was without blemiſh, ſo was Chriſt without ſin.—From theſe and other circumſtances, the apoſtle applied the term paſsover to Chriſt.

Thus, alſo, we are to account for what St. Paul calls the baptiſm of the children of Iſrael in the cloud, and in the ſea; and for the compariſon betwixt the high prieſt entering the holy place every year, and Chriſt entering into heaven.

TYPE *of Conſtans*, a formulary or model of faith, publiſhed by the emperor Conſtans, who being a favourer of the Monothelites, and exaſperated at the little ſucceſs which the ecthesis of his uncle Heraclius had met with, publiſhed a new formulary in the manner of an edict in 648, forbidding all perſons to make uſe of the expreſſions "one, or two wills in Jeſus Chriſt."

Martin I. condemned the type in the Lateran council, anno 649, and the ſynod made a canon expreſsly againſt this heretical model; at which the emperor was ſo enraged, that he forced the pope into baniſhment.

TYPE, among letter-founders and printers, the ſame with letter. See the articles LETTER, and LETTER-FOUNDERY.

TYPE is alſo uſed to denote the order obſerved in the intenſion and remiſſion of fevers, pulſes, &c.

TYPHA, in botany, a genus of plants, having no corolla: the male flowers are arranged into a cylindric amentum; the female flowers form alſo a cylindric amentum below the male ones; there is no pericarpium, the fruit growing together in great numbers, conſtitutes a cylinder, in each of which there is a ſingle ovated ſeed, furniſhed with a ſtyle, and ſtanding upon a ſeta, which ſeta ſtands on a capillary pappus.

TYPHODES, τυφωδης, or τυφος, in medicine, a kind of ardent or burning fever uſually attending on eryſipelaſes of any of the viſcera. Of this diſorder, according to Hippocrates, there are five ſpecies. The firſt is a legitimate continual fever, which impairs the ſtrength, is accompanied with a pain of the belly, and a preternatural heat of the eyes, hinders the patient from looking ſteadily on any object whatſoever, and renders him unable, in conſequence of the violent pain, to ſpeak. The ſecond ſpecies begins with a tertian or quartan fever. The patient diſcharges a great quantity of ſaliva and worms at his mouth; his eyes are painful, his feet and ſometimes his whole body, are ſeized with ſoft ſwellings. His breaſt and back are now and then painful; his belly rumbles, his eyes are fierce, he ſpits a great deal, and his ſaliva ſticks to his throat. The third ſpecies is known by intenſe pains in the joints, and ſometimes over all the body; the blood contaminated by the bile, becomes hot and ſtagnates in the limbs. The fourth ſpecies is known by a violent tenſion; elevation, and heat of the abdomen, ſucceeded by a diarrhæa, which ſometimes ends in a dropſy. The fifth ſpecies is not unlike the firſt. See the article FEVER.

TYPHOMANIA, τυφομανια, in medicine, a diſorder of the brain, wherein the patient not being able to ſleep, though greatly inclined thereto, lies with his eyes ſhut, talks abſurdly, and flings himſelf this way and that. The typhomania is a kind of combination of a frenzy with a lethargy, and is much the ſame with coma vigil.

TYPOGRAPHY, the art of printing. See PRINTING.

TYPHON, in church-hiſtory, a god of the ancient Egyptians, This people admitted two principles, the one good, the other bad. Iſis, Oſiris, and Orus were good gods, and Typhon the evil god. To this latter they imputed tempeſts, inundations, earthquakes, eclipſes, and all misfortunes. The aſs and the crocodile were his ſymbols; and he had divine honours paid him in that part of Egypt called Papremis.

Typhon, according to Diodorus Siculus, was brother to Oſiris, who reigned in Egypt with great juſtice and equity, but Typhon was a violent and cruel man. He killed his brother, and cut his body into twenty-ſix parts.—But Iſis, the wife of Oſiris, and their ſon Orus, put Typhon to death, by drowning him in the river Orontes. The Typhæus of the Greeks is, probably, the ſame as the Egyptian Typhon.

M. Jurieu has drawn a kind of parallel between Moſes and Typhon. The name of Typhon, he ſays, ſignifies, in the Hebrew and Phœnician language, inundation: and this name is applicable to Moſes, who cauſed the Egyptians, and their king, to be drowned in the Red Sea. Typhon was the grand enemy of the Egyptian gods: this reſpects the declaration made by God to Moſes, when he inſtituted the paſſover; "Againſt all the gods of Egypt I will exerciſe judgment." Typhon joined with 72 conſpirators, to kill his brother: this is Moſes, who led the children of Iſrael out of Egypt, and governed them in the wilderneſs with the help of 70 elders. Typhon was the brother of Oſiris: Moſes was reputed the ſon of Pharaoh's daughter, and conſequently related to the king of Egypt. Typhon, having been defeated, fled away upon an aſs for ſeven days; here we have the flight of Moſes and the Iſraelites, and the inſtitution of the ſeventh day, or the ſabbath. Theſe are the principal circumſtances of the parallel; of which the reader is left to judge.

TYRANT, *Tyrannus*, among the ancients, denoted ſimply a king or monarch. But the ill uſe ſeveral perſons inveſted with that ſacred character made of it, has altered the import of the word, and tyrant now carries with it the idea of an unjuſt and cruel prince, who invades the people's liberty, and rules in a more diſpotic manner than the laws of nature or the country do allow of.

TYROCINIUM, a noviciate, or apprenticeſhip, in any art or ſcience.

TYROSIS, a diſorder of the ſtomach, proceeding from milk coagulated therein.

TYTHES, or TITHES. See the article TITHES.

U.

U.

VAC

U, the twentieth letter in the alphabet, and the fifth vowel. The letter U ſeems to owe its origin to the V conſonant, though it is abſolutely as different a letter from that, as E and F. It is formed in the voice by a round configuration of the lips, and a greater extruſion of the under one; the tongue is alſo more canulated than in forming the O; elſe other things are much the ſame.

V is alſo, a numeral letter, and ſignifies five; and with a daſh at top, thus $\overline{V}$, it ſignified five thouſand.

The letter V, we find, was in the moſt ancient Greek alphabet, by the Sigean inſcription. And, as it had the force of the Hebrew Vau, ſo it might, probably, be formed from thence; though the figure of the letter, in the moſt ancient Eaſtern alphabets, does not approach very near it; nor is the Phœnician ϒ ſo very remote, as not to ſlip eaſily into it, by carrying the right-hand ſtroke down to the bottom of the other, before it was made to join it. The power or ſound of V and F is, by moſt grammarians, ſuppoſed to be nearly the ſame; but they are widely different, in all reſpects, even in the vocal formation; for V is ſounded in a much ſlower and more obtuſe expreſſion of the breath, and application of the upper teeth to the under lip, than is done in pronouncing F, where the voice is more clear and acute. Beſides, how very different is the ſound of vulgar and fulgar? which, with many inſtances of the like kind, prove V and F to be very different letters.

VACANCY, in philoſophy. See the article VACUUM.

VACANCY, in law, a poſt, or benefice, wanting a regular officer or incumbent.

VACANT EFFECTS, *prædia vacata*, or *vacua*, are ſuch as are abandoned for want of an heir, after the death or flight of their former owner. A Romiſh benefice is ſaid to be vacant in curia Romana, when the incumbent dies in Rome, or within twenty leagues thereof, though it be only by accident that he was there. The pope nominates to all ſuch benefices.

VACATION, in law, is the whole time betwixt the end of one term and the beginning of another.

This word is alſo applied to the time from the death of a biſhop, or other ſpiritual perſon, till the biſhopric, or dignity, is ſupplied with another.

VACCINUM, Billberry, Whortleberry, or Cranberry, in botany, a genus of plants, the flower of which has a ſmall permanent empalement ſitting upon the germen; it is bell-ſhaped, of one petal, ſlightly cut into four ſegments at the brim, which turn backward; it has eight ſtamina, terminated by horned ſummits, having two awns on their backſide which ſpread aſunder. The germen is ſituated below the flower, ſupporting a ſingle ſtyle longer than the ſtamina, crowned by an obtuſe ſtigma; it afterwards turns to an umbilicated globular berry with four cells, containing a few ſmall ſeeds.

VAC

There are five ſpecies of this plant, the firſt of which grows very common upon large wild heaths, in many parts of England, but is never cultivated in gardens, it being with great difficulty tranſplanted; nor will it thrive long when moved thither; for from many trials which I have made, by taking up the plants at different ſeaſons with balls of earth to their roots, and planting them in gardens, I could never ſucceed ſo as to preſerve the plants above two years, and thoſe never produced any fruit, ſo that it is not worth the trouble of cultivating.

The fruit of this ſort is gathered by the poor inhabitants of thoſe villages which are ſituated in the neighbourhood of their growth, and carried to the market towns. Theſe are by ſome eaten with cream or milk; they are alſo put into tarts, and much eſteemed by the people in the north, but they are ſeldom brought to London. The ſhrub on which theſe grow, riſes about two feet high, having many ſtems which are garniſhed with oblong leaves, ſhaped like thoſe of the box-tree, but ſomewhat longer, and are a little ſawed on their edges. The flowers are ſhaped like thoſe of the arbutus, or ſtrawberry-tree, of a greeniſh white colour, changing to a dark red towards the top. The fruit are bout the ſize of large juniper-berries, and of a deep purple colour, having a flue upon them when they are untouched, like the plums, which rub off with handling.

The ſecond ſort is of a much humbler growth, ſeldom riſing above ſix or eight inches high. The leaves of this are ſo alike that of the dwarf box, as that, at a diſtance, the plants are often taken for it even by perſons of ſkill. This is an ever-green, which grows upon moory ground in ſeveral parts of the north, but it is full as difficult to tranſplant into gardens, as the other ſort, though I have been aſſured by perſons of credit, that they have ſeen this ſort planted to make edgings to the borders of the gardens in Norway and Sweden, where the plants may grow much better from the cold of thoſe climates, than they will do in England, for this is a native of very cold countries. I have ſeveral times received plants of this ſort from Greenland, by the whale ſhips. The berries of this ſort are red, and have a more agreeable acid flavour than thoſe of the firſt ſort. The fruit is frequently uſed for tarts in ſeveral of the northern counties, where the plants grow wild upon the moors.

The third ſort grows naturally in Virginia and other parts of North America; this has a low ſhrubby ſtalk like the ſecond. The leaves are ſmall, oval, pointed, and not unlike ſome ſorts of myrtle; they continue green all the year. The flowers come out from the wings of the leaves at every joint; their foot ſtalks are pretty long, and nod downwards; they ſuſtain but one flower; they are ſmall, white, and are ſucceeded by ſmall red berries which ſeldom ripen here.

The

The fourth ſort grows naturally in marſhy grounds in moſt parts of North America. The ſtalks of this are ſlender, imbricated, and trail upon the ground; the ſcales are briſtly; the leaves are oval, entire, and their edges turn backwards; the flowers come out from the wings of the ſtalk, of an herbaceous white colour, and in their native ſoil are ſucceeded by large red berries, but in England the fruit comes to perfection.

The plants of this ſort are difficult to preſerve in England, for they require a mooriſh, boggy ſoil, which ſhould be covered with moſs, and conſtantly kept wet, otherwiſe they will not thrive.

The fifth ſort produces long ſlender branches, not bigger than thread, which trail upon the moſſy bogs, ſo are often hid by the moſs. Theſe branches are thinly garniſhed with ſmall leaves, about the ſize and ſhape of thoſe of thyme, having their upper ſurface of a ſhining green colour, but are white underneath. The flowers are generally produced towards the extremity of the ſhoots, which are in ſhape like thoſe of the former ſorts, but are ſmaller, and of a red colour; theſe grow upon long ſlender foot-ſtalks, and are ſucceeded by round, red, ſpotted berries, of a ſharp acid flavour, which are much eſteemed by the inhabitants of the places near the bogs where they grow. Some uſe them for tarts, and others eat them with milk or cream.

This ſort is a native of bogs, therefore cannot by any art be propagated upon dry land; but where there are natural bogs the plants may be taken up carefully, preſerving ſome of the ſoil to their roots, and tranſplanted into the bogs in the autumn; and if they are at once fixed in the place, they will ſpread and propagate in great plenty, and require no farther care.

The two ſorts firſt mentioned alſo propagate very faſt by their creeping roots, ſo that when they are fixed in a proper ſoil, they will ſoon overſpread the ground, for the heaths, upon which they naturally grow, are generally covered with the plants. This firſt ſort grows with the heath, their roots intermixing together, and frequently is found upon ſandy heaths in divers parts of England; but the ſecond ſort grows only upon mooriſh land, where, by its creeping roots, the ground is ſoon covered with the plants.

There are ſeveral other ſpecies of this genus, ſome of which are natives of Spain and Portugal, others of Germany and Hungary, and ſeveral of the northern parts of America, from whence thoſe large fruit are brought to England, which are uſed by the paſtry-cooks of London, during the winter ſeaſon for tarts; but as all theſe ſorts naturally grow upon ſwamps and bogs, they are not eaſy to tranſplant into gardens in their native country, ſo as to thrive, or produce fruit, therefore there can be little hopes of cultivating them to advantage in England. *Miller's Gard. Dict.*

VACUUM, VACUITY, in phyſics, a ſpace empty or devoid of all matter, or body.

Whether there be any ſuch thing in nature as an abſolute vacuum; or whether the univerſe be completely full, and there be an abſolute plenum; is a thing that has been controverted by the philoſophers of all ages.

The ancients, in their controverſies, diſtinguiſhed two kinds; a vacuum *coacervatum*, and a vacuum *interſperſum*, or *diſſeminatum*.

VACUUM *Coacervatum*, is conceived as a place deſtitute of matter: ſuch, e. gr. as there would be, ſhould God annihilate all the air, and other bodies within the walls of a chamber.

The exiſtence of ſuch a vacuum is maintained by the Pythagoreans, Epicureans, and the Atomiſts or Corpuſcularians; moſt of whom aſſert ſuch a vacuum actually to exiſt without the limits of the ſenſible world. But the modern Corpuſcularians, who hold a vacuum coacervatum, deny that application; as conceiving, that ſuch a vacuum muſt be infinite, eternal, and uncreated.

According, then, to the later philoſophers, there is no vacuum coacervatum without the bounds of the ſenſible world; nor would there be any other vacuum, provided God ſhould annihilate divers contiguous bodies, than what amounts to a mere privation, or nothing; the dimenſions of ſuch a ſpace, which the ancients held to be real, being by theſe held to by mere negations; that is, in ſuch a place, there is ſo much length, breadth, and depth wanting, as a body muſt have to fill it. To ſuppoſe, that when all the matter in a chamber is annihilated, there ſhould yet be real dimenſions, is to ſuppoſe corporeal dimenſions without body; which is abſurd.

The Carteſians, however, deny any vacuum coacervatum at all; and aſſert, that if God ſhould immediately annihilate all the matter, v. gr. in this chamber, and prevent the ingreſs of any other matter, the conſequence would be, that the walls would become contiguous, and include no ſpace at all. They add, that if there be no matter in a chamber, the walls can be conceived no otherwiſe than as contiguous; thoſe things being ſaid to be contiguous, between which there is not any thing intermediate: but, if there be no body between, there is no extenſion between; extenſion and body being the the ſame thing: and if there be no extenſion between, then the walls are contiguous; and where is the vacuum? But this reaſoning is built on a miſtake, viz. that body and extenſion are the ſame thing.

VACUUM *Diſſeminatum*, or *Interſperſum*, is that ſuppoſed to be naturally interſperſed in and among bodies, in the pores of the ſame body, and in the interſtices between different bodies.

It is this kind of vacuum which is chiefly diſputed among the modern philoſophers: the Corpuſcularians ſtrenuouſly aſſerting it; and the Peripatetics, and Carteſians, as ſtifly impugning it.

The great argument the Peripatetics urge againſt a vacuum interſperſum, is, that there are divers bodies frequently ſeen to move contrary to their own nature, and inclination; and that for no other apparent reaſon, but to avoid a vacuum; whence they conclude, that nature abhors a vacuum; and give us a new claſs of motions aſcribed to the gravity, and preſſure of the atmoſphere.

The Carteſians deny not only the actual exiſtence, but even the poſſibility of a vacuum: and that on this principal, that extenſion being the eſſence of matter, or body, wherever extenſion is, there is matter: but mere ſpace, or vacuity, is ſuppoſed to be extended; therefore it is material. Whoever aſſerts an empty ſpace, they ſay, conconceives dimenſions in that ſpace; that is, he conceives an extended ſubſtance in it; and therefore he denies a vacuum, at the ſame time that he admits it. On the other hand, the Corpuſcular authors prove, not only the poſſibility, but the actual exiſtence of a vacuum, from divers conſiderations; particularly, from the conſideration of motion in general; and that of the planets, comets, &c. in particular; from the fall of bodies; from the vibration of pendulums; from rarefaction and condenſion; from the different ſpecific gravities of bodies; and from the diviſibility of matter into parts.

1. It is argued, that motion could not be affected without a vacuum.—This is what Lucretius urged long-ago,— *Principium quoniam cedendi nulla daret res—undique materies quoniam ſtipata fuiſſet.*

The force of this argument will be increaſed from the two following conſiderations, viz. firſt, that all motion is either in a ſtraight line, or in a curve which returns into itſelf, as the circle, and ellipſis; or in a curve that does not return into itſelf, as the parabola, &c. And, ſecondly, that the moving force muſt always be greater than the reſiſtance.

For, hence it follows, that no force, even though infinite, can produce motion where the reſiſtance is infinite; conſequently, there can be no motion either in a ſtraight line, or a non-returning curve; becauſe, in either of thoſe caſes, the protruſion, and conſequently the reſiſtance, would be infinite. — There remains, therefore, only the motion in a revolving curve practicable; this muſt either be a revolution upon an axis, or an annular motion round a quieſcent body; and conſequently, all motion muſt be in circles geometrically true; and the revolving bodies muſt either be ſpheres, ſpheroids, cylinders, or portions of them, exactly geometrical; otherwiſe, the revolutions in a plenum would be

be impoſſible: but ſuch motions, or ſuch figured bodies, we do not know in nature. Therefore there is a vacuum.

2. The motions of the planets and comets, demonſtrate a vacuum: thus Sir Iſaac Newton ſays, —"That there is no ſuch fluid medium as æther, to fill up the porous parts of all ſenſible bodies, as the air and interſtellar parts, and ſo make a plenum, ſeems probable; becauſe the planets and comets proceed with ſo regular and laſting a motion, through the celeſtial ſpaces, both from and to all parts: for hence it appears, that thoſe celeſtial ſpaces are void of all ſenſible reſiſtance, and conſequently of all ſenſible matter. For the reſiſting force of fluid mediums, ariſes partly from the attrition of the parts of the medium, and partly from the inactivity of matter.—Now, that part of the reſiſtance of any medium, which ariſes from the tenacity, or attrition of its parts, may be leſſened by dividing the matter into ſmaller parts, and by rendering thoſe parts more ſmooth and ſlippery: but that part of the reſiſtance which ariſes from the inactivity of matter, is always in proportion to the denſity of the matter; nor can it be diminiſhed by dividing the matter, nor by any other means, except by diminiſhing the denſity thereof."

Conſequently, if the celeſtial regions were as denſe as water, or as quickſilver; they would reſiſt almoſt as much as water or quickſilver; but if they were perfectly denſe, without any interſperſed vacuity, though the matter were ever ſo fluid and ſubtile, they would reſiſt more than quickſilver does; a perfectly ſolid globe, in ſuch a medium, would loſe above half its motion in moving three lengths of its diameter; and a globe not perfectly ſolid, ſuch as the bodies of the planets and comets are, would be ſtopped ſtill ſooner. Therefore, that the motion of the planets and comets may be regular, and laſting, it is neceſſary the celeſtial ſpaces be void of all matter, except perhaps ſome few, and much rarified effluvia of the planets and comets, and the paſſing rays of light."

3. The ſame great author deduces a vacuum alſo from the conſiderations of the weights of bodies; thus: "All bodies about the earth gravitate towards the earth; and the weights of all bodies, equally diſtant from the earth's center, are as the quantities of matter in thoſe bodies. If the æther, therefore, or any other ſubtile matter, were altogether deſtitute of gravity, or did gravitate leſs than in proportion to the quantity of its matter; becauſe, as Ariſtotle, Des Cartes, and others argue, it differs from other bodies only in the form of the matter; the ſame body might, by the change of its form, gradually be converted into a body of the ſame conſtitution with thoſe which gravitate moſt in proportion to the quantity of matter: and, on the other hand, the moſt heavy bodies might gradually loſe their gravity, by gradually changing their form; and therefore the weights would depend upon the forms of bodies, and might be changed with them; which is contrary to all experiment."

4. The deſcent of bodies proves that all ſpace is not equally full; for the ſame author goes on, "If all ſpaces were equally full, the ſpecific gravity of that fluid, with which the region of the air would in that caſe be filled, would not be leſs than the ſpecific gravity of quickſilver or gold, or any other the moſt denſe body; and therefore neither gold, nor any other body, could deſcend therein. For bodies do not deſcend in a fluid, unleſs that fluid be ſpecifically lighter than the body.—But by the air pump, we can exhauſt a veſſel, till even a feather ſhall fall with a velocity equal to that of gold in the open air: the medium, therefore, through which this feather falls, muſt be much rarer than that through which the gold falls in the other caſe."

"The quantity of matter, therefore, in a given ſpace, may be diminiſhed by rarefaction: and why may not it be diminiſhed in infinitum? Add, that we conceive the ſolid particles of all bodies to be of the ſame denſity; and that they are only rarefiable by means of their pores: and hence a vacuum evident follows."

5. "That there is a vacuum, is evident from the vibrations of pendulums: for ſince thoſe bodies in places out of which the air is exhauſted, meet with no reſiſtance to retard their motion, or ſhorten their vibrations; it is evident there is no ſenſible matter in thoſe ſpaces, or in the occult pores of thoſe bodies."

As to what Des Cartes urges of his materia ſubtilis, that its tenuity prevents its reſiſtance from being ſenſible, and that a ſmall body ſticking againſt a greater, cannot in the leaſt prove, or reſiſt the motion of that other; but is reflected back again with all its momentum: it is contrary to all experience. For Sir Iſaac proves, that the denſity of fluid mediums, is proportionable to their reſiſtances, very nearly; and that they are exceedingly miſtaken, who ſuppoſe the reſiſtance of projectiles to be infinitely diminiſhed, by dividing the parts of the fluid, even in infinitum. When, on the contrary, it is clear the reſiſtance is but little diminiſhed by the ſubdiviſion of the parts; and that the reſiſting forces of all fluids are nearly as their denſities.—For why ſhould not the ſame quantity of matter, whether divided into a greater number of ſubtile parts, or into a few larger ones, have the ſame reſiſting force? If then there were no vacuum, it would follow, that a projectile moving in the air, or even in a ſpace whence the air is exhauſted, ſhould move with as much difficulty as it would in quickſilver; which is contrary to experience.

6. That there are interſperſed vacuities, appears from matter's being actually divided into parts, and from the figures of thoſe parts: for, on ſuppoſition of an abſolute plenitude, we do not conceive how any part of matter could be actually divided from that next adjoining, any more than it is poſſible to divide actually the parts of abſolute ſpace from one another: for by the actual diviſion of the parts of a continuum from one another, we conceive nothing elſe underſtood, but the placing thoſe parts at a diſtance from one another, which, in the continuum, were at no diſtance from one another: but ſuch diviſions between the parts of matter, muſt imply vacuities between them.

7. As for the figures of the parts of bodies, upon the ſuppoſition of a plenum, they muſt either be all rectilinear, or all concavo-convex; otherwiſe, they would not adequately fill ſpace; which we do not find to be true in fact.

8. The denying a vacuum, ſuppoſes what it is impoſſible for any one to prove to be true; viz. that the material world has no limits.

Since then the eſſence of matter does not conſiſt in extenſion, but in ſolidity, or impenetrability, the univerſe may be ſaid to conſiſt of ſolid bodies moving in a vacuum: nor need we at all fear, leſt the phænomena of nature, moſt of which are plauſibly accounted for from a plenitude, ſhould become inexplicable when the plenum is ſet aſide.—The principal ones, ſuch as the tides; the ſuſpenſion of the mercury in the barometer; the motion of the heavenly bodies, and of light, &c. are more eaſily and ſatisfactorily accounted for from other principles.

VACUUM BOYLEANUM is ſometimes, though improperly, uſed to expreſs the approach to a real vacuum, by means of an air pump. See the laſt article, AIR, and PUMP.

VADARI, in the civil-law, denotes a perſon to pledge, undertake, or give ſecurity, in behalf of another, that he ſhall, on a certain day, appear in court to proſecute or anſwer.

VADE-MECUM, or VENI-MECUM, a Latin phraſe, uſed, in Engliſh, to expreſs a thing that is very handy and familiar, aud which one uſually carries about with them; chiefly applied to ſome favourite book.

VADIMONIUM, in the civil-law, a promiſe, or bond, given for appearance before the judge upon a day appointed.

VAGABOND, in law. See VAGRANTS.

VAGINA, properly ſignifies a ſheath, or ſcabbard; and the term vagina is uſed, in architecture, for the part of a terminus, becauſe reſembling a ſheath, out of which the ſtatue ſeems to iſſue.

VAGINA, in anatomy, a large canal, formed of a robuſt and ſtrong membrane, and reaching from the external orifice, or os pudendi, in women, to the uterus.

The vagina is uſually about ſix or ſeven fingers breadth long; but is very diſtenſible, and capable of great dilata-

tion; its orifice is narrower than any other part, and cloſed by a ſphincter muſcle: its ſubſtance is membranaceous, and rugoſe internally, and furniſhed with abundance of nervous papillæ; and to this is owing its quick ſenſation; externally it is muſcular, where it is enabled to embrace the penis more cloſely in coitu. The rugæ are largeſt in maids, and eſpecially in the anterior part of the vagina; in married women they are much fainter, and ſeem as if worn down; and in women who have born children, they are almoſt entirely obliterated. Their uſe is to encreaſe the pleaſure in coitu, both to the man and to the woman; and to render the part capable of the neceſſary dilatation in parturition.

About the mouth of the vagina are found certain lacunæ, or ſmall orifices, capable of admitting a briſtle: they proceed from the glandulæ ſubſtratæ, and ſerve to ſecrete a liquor for lubricating the vagina, and for ſtimulating to venery.

The uſe of the vagina is to receive the penis in coition, to emit from the womb the menſtrual diſcharges, the fœtus, the ſecundines, and lochia.

VAGINALIS, or ELYTROIDES, in anatomy. See ELYTROIDES.

VAGRANTS, in law, are deſcribed to be perſons pretending to be patent-gatherers, or collectors for priſons, and wander about for that end; among which are included all fencers, bear-wards, common players of interludes, minſtrels, juglers; all perſons pretending to be gypſies, or wandering in the habits of ſuch, or pretending ſkill in phyſiognomy, palmeſtry, or the like, or to tell fortunes; all ſuch as uſe any ſubtle craft, unlawful games or plays; or, being able in body, run away, leaving their wives or children to the pariſh; all perſons who cannot otherwiſe maintain themſelves, that loiter about and refuſe to work for the uſual wages; and all other perſons wandering abroad and begging, &c.

It is enacted, that where any ſuch vagrants ſhall be found in a pariſh, the conſtable, or other officer, is immediately to apprehend them, and carry them before ſome juſtice of the peace, who ſhall examine the perſons on oath, as to their condition, and places of abode; and thereupon order them to be ſent by paſs to the place of their laſt legal ſettlement; or if that cannot be known, to the place of their birth. The juſtice is to give the conſtable a certificate aſcertaining how, and in what manner, they ſhall be conveyed, &c. And juſtices of the peace in their ſeſſions, have power to appoint rates for paſſing of vagrants, at ſo much per mile. All conſtables are to make ſearches for theſe people before every quarter-ſeſſions; and in caſe any perſons permit vagrants to lodge in their houſes, barns or out-houſes, and do not carry them before the next juſtice, or give notice to ſome conſtable, or other pariſh-officer, ſo to do, they ſhall forfeit a ſum not above 40s. or under 10s. Alſo, if any charge be brought upon any place by means thereof, the ſame may be levied by diſtreſs and ſale of the offender's goods; for want of which he ſhall be committed to the houſe of correction, and there ſet to hard labour for three months.

VAGUM, or PAR VAGUM, in anatomy, the eighth pair of the nerves ariſing from the medulla oblongata.

VAIR, in heraldry, a kind of fur, conſiſting of divers little pieces, argent and azure, reſembling a Dutch U, or a bell-glaſs.

Vairs have their point azure oppoſite their point argent, and the baſe argent to the baſe azure.

VAIRY, VAIRE, VERRY, or VARRY, in heraldry, expreſſes a coat, or the bearings of a coat, when charged or chequered with vairs: and hence, vairy-cuppy, or vairy-taſſy, is a bearing compoſed of pieces repreſenting the tops of crutches.

VALENTINIANS, in church hiſtory, a ſect of Chriſtian heretics, who ſprung up in the ſecond century, and were ſo called from their leader Valentinus.

This ſect was one of the moſt famous, and moſt numerous among the ancients. Valentinus, who was the author of it, was an Egyptian, and began their to teach the doctrine of the Gnoſtics. His merit made him aſpire to the epiſcopacy; but, another having been preferred before him, Valentinus, enraged at this denial, and reſolved to revenge himſelf of the affront given him, departed from the doctrine of the Church, and revived old errors. He began to preach his doctrine in Egypt, and from thence coming to Rome, under the pontificate of pope Hyginus, he there ſpread his errors, and continued to dogmatize till the pontificate of Anicetus, that is, from rhe year 140 to 160.

Of all the Gnoſtics none formed a more regular ſyſtem than Valentinus. His notions were drawn from the principles of the Platoniſts. The Æons were attributes of the Deity, or Platonic ideas, which he realized, or made perſons of them, to compoſe thereof a complete Deity, which he called Pleroma, or Plenitude; under which was the Creator of the world, and the angels, to whom he committed the government of it. The moſt ancient heretics had already eſtabliſhed thoſe principles, and invented genealogies of the Æons: but Valentinus, refining upon what they had ſaid, placed them in a new order, and thereto added many fictions. Their ſyſtem was this: the firſt principle is Bythos, that is Depth: it remained for many ages unknown, having with it Ennoe, i. e. Thought, and Sige, i. e. Silence. From theſe ſprung the Nous, or Intelligence, which is the only ſon, equal to it alone, and capable of comprehending it; whoſe ſiſter is Aletheia, that is, Truth. This is the firſt quaternity of Æons, which is the ſource and original of all the reſt. For Nous and Aletheia produced the Word and the Life; and from theſe two proceeded Man and the Church. This is the ſecond quaternity of the eight principal Æons. The Word and the Life, to glorify the Father, produced five couple of Æons: Man and the Church formed ſix. Theſe thirty Æons bear the name of attributes and compoſe the Pleroma, or Plenitude of the Deity. Sophia, or Wiſdom, the laſt of theſe Æons, being deſirous to arrive at the knowledge of Bythos, gave herſelf a great deal of uneaſineſs, which created in her Anger and Fear, of which was born Matter. But the Horos, or Bounder, ſtopped her, preſerved her in the Pleroma, and reſtored her to perfection. Then ſhe produced the Chriſt, and the Holy ſpirit, which brought the Æons to their laſt perfection, and made every one of them contribute their utmoſt to form the Saviour. Her Enthymeſe, or Thought, dwelling near the Pleroma, perfected by the Chriſt, produced every thing that is in the world, by its divers paſſions. The Chriſt ſent into it the Saviour, accompanied with angels, who delivered it from its paſſions, without annihilating it; and from thence was formed corporeal matter, which was of two ſorts; the one bad, ariſing from the paſſions; the other good, proceeding from converſion, but ſubject to the paſſions.

The diſciples of Valentinus did not ſtrictly confine themſelves to his ſyſtem. They took a great deal of liberty, in ranging the Æons according to their different ideas, without condemning one another upon that account. But what is moſt abominable is, that from theſe chimerical principles they drew deteſtible concluſions as to morality: for, becauſe ſpiritual beings could not periſh, being good by nature, hence they concluded, that they might freely, and without ſcruple, commit all manner of actions, and that it was not at all neceſſary for them to do good; but above all, they believed continence to be uſeleſs. We have, in Clemens Alexandrinus, an extract of a letter of Valentinus, in which he maintains, that God does not require the martyrdom of his children, and that, whether they deny or confeſs Chriſt before tyrants, they ſhall be ſaved. If they believed that good works were neceſſary, it was only for animal men. Some believed, that baptiſm by water was ſuperfluous: others baptized in the name of the unknown Father, of the truth the mother of all, of him who deſcended in Jeſus, of the light redemption, and community of powers. Many rejected all outward ceremonies.

In fine, the errors of the Valentinians were wholly incompatible with the Chriſtian doctrine. If they did not deſtroy the unity of God, they made of him a monſtrous compoſition of different beings. They attributed the creation to another principle: they ſet up good and bad ſubſtances by nature. Jeſus Chriſt, according to them, was but a man in whom the celeſtial Chriſt deſcended. The Holy Ghoſt was but a ſimple divine virtue. There is no reſurrection of the body. Spiritual men do not

merit eternal life; it is due to them by their nature; and do what they will, they can never miſs of it; as material men cannot eſcape annihilation, although they live an unblameable life.

VALERIAN, in botany, a genus of plants, with channelled ſtalks; the leaves are in pairs, each leaf being compoſed of a number of long narrow ſharp-pointed ſegments, indented about the edges, of a dull green colour, ſet along a middle rib, which is terminated by an odd one; producing, on the tops of the ſtalks, umbel-like cluſters of ſmall monopetalous flowers, each of which is divided into five ſegments, ſet in a very little cup, and followed by a ſingle naked ſeed winged with down: the root conſiſts of tough ſtrings with numerous ſmaller threads, matted together, iſſuing from one head, of a duſky browniſh colour approaching to olive. It is perennial, and grows wild in dry mountainous places.

Another ſpecies, or variety, or wild valerian, is met with in moiſt watery grounds, diſtinguiſhable by the leaves being broader and of a deep gloſſy green colour. Both ſorts have been uſed indiſcriminately: but the mountain ſort is by far the moſt efficacious, and is therefor expreſsly ordered for the officinal ſpecies by the London college.

The mountain valarian root has a ſtrong not agreeable ſmell, and an unpleaſant warm bitteriſh ſabacrid taſte: the ſtrength of the ſmell and taſte is the only mark to be depended on of its genuineneſs and goodneſs. It is a medicine of great eſteem in the preſent practice againſt obſtinate hemicraniæ, hyſterical, and the different kinds of nervous diſorders, and is commonly looked upon as one of the principal antiſpaſmodics. Calumna reports, that he was cured by it of an inveterate epilepſy after many other medicines had been uſed in vain: on more extenſive trials it has been found, in ſome epileptic caſes to effect a cure, in ſeveral to abate the violence or frequency of the fits, and in many to prove entirely ineffectual: oftentimes, it either purges, or operates by ſweat or by urine, or brings away worms, before it prevents a fit. The doſe of the root in powder is from a ſcruple to a dram or two, which may be repeated, if the ſtomach will bear it, two or three times a day.

The powdered root, infuſed in water or digeſted in rectified ſpirit, impregnates both menſtrua ſtrongly with its ſmell and taſte, and tinges the former of a dark brown, the latter of a browniſh red colour. Water diſtilled from it ſmells conſiderably of the root, but no eſſential oil ſeparates though ſeveral pounds be ſubmitted to the operation at once: the extract obtained by inſpiſſating the watery infuſion, has a pretty ſtrong taſte, diſagreeably ſweetiſh and ſomewhat bitteriſh: the ſpirituous extract is leſs diſagreeable, and more perfectly reſembles the root itſelf: the quantity of watery extract is about one fourth the weight of the root; of the ſpirituous, about one eighth. Tinctures of it are prepared in the ſhops, by digeſting four ounces of the powdered valerian in a quart of proof ſpirit; in the ſame quantity of the volatile aromatic ſpirit; in three quarts of mountain wine, with the addition of an ounce of Virginian ſnakeroot, and half an ounce of roſemary tops. The root in ſubſtance, however, is generally found to be more effectual than any preparation of it. Among the materials I have made trial of for covering its flavour, mace ſeemed to anſwer the beſt. *Lewis's Materia Medica.*

VALET, a French term, uſed as a common name for all domeſtic men ſervants, employed in the more ſervile officers, as grooms, footmen, coachmen, &c. But with us, it is only uſed in the phraſe valet de chambre, which is a ſervant whoſe office is to dreſs and undreſs his maſter, &c.

VALET, in the manage, a ſtick armed at one end with a blunted point of iron, to prick and aid a leaping horſe.

VALETUDINARY, *Valetudinarius*, among medical writers, denotes a perſon of a week and ſickly conſtitution, and frequently out of order.

VALID, in law, an apellation given to acts, deeds, tranſactions, &c. which are clothed with all the formalities requiſite to their being put into execution, and to their being admitted in a court of juſtice.

VALLAR CROWN, *valaris corona*, in Roman antiquity, the ſame with that otherwiſe called caſtrenſis. See CROWN.

VALUE, *Valor*, in commerce, denotes the price or worth of any thing: hence the intrinſic value denotes the real and effective worth of a thing, and is uſed chiefly with regard to money, the popular value whereof may be raiſed and lowered, at the pleaſure of the prince; but its real, or intrinſic value, depending wholly on its weight and fineneſs, is not at all affected by the ſtamp or impreſſion thereon.

Value in bills of exchange, is uſed to ſignify the nature of the thing (as ready money, bills, debts, merchandizes, &c.) which is given, as it were, in exchange for the ſum ſpecified in the bill. From four different manners of expreſſing this value, ſome diſtinguiſh four kinds of bills of exchange. The firſt bears value received, ſimply and purely, which comprehends all kinds of value; the ſecond value received in money or merchandize; the third value of myſelf; and the fourth underſtood. See the article BILL.

VALVE, *Valvula*, in hydraulics, pneumatics, &c. is a kind of lid, or cover of a tube or veſſel, ſo contrived as to open one way; but which, the more forcibly it is preſſed the other way, the cloſer it ſhuts the aperture; ſo that it either admits the entrance of a fluid into the tube or veſſel, and prevents its return; or admits its eſcape, and prevents its re-entrance. See PUMP.

The word is formed from the Latin *valvæ*, folding doors.

VALVE, in anatomy, a thin membrane applied on ſeveral cavities and veſſels of body to afford a paſſage to certain humours going one way, and prevent their reflux towards the place from whence they came. The veins and lymphatics are furniſhed with valves, which open towards the heart, but keep cloſe towards the extremities of thoſe veſſels; that is, they let the blood and lymph paſs towards the heart, but prevent their returning towards the extreme parts from whence they came,

The heart has alſo its valves, placed at the entrance of the veſſels riſing out of it. Thoſe at the entrance of the vena cava, and pulmonary vein, let the blood paſs on to the heart, and prevent its return: on the contrary thoſe at the entrance of the aorta, and pulmonary artery, let the blood paſs out of the heart, and prevent its flowing back again. See the articles HEART and ARTERY.

The upper and, as it were, the lid of the iſthmus, between the teſtes and the firſt vermicular proceſs of the cerebellum, is called the valvula magna, or the great valve of the brain. Its uſe is to prevent the lymph from falling on the nerves, at the baſe of the cranium. See BRAIN.

The colon has a thick valve to prevent the excrements from paſſing into the ilion, and ſeveral other valves to retard the deſcent of the excrements.

VAN, VANT, or VAUNT, a term derived from the French *avant*, or *avaunt*, ſignifying *before*, or *foremoſt* of any thing: thus we ſay, the van-guard of an army, &c.

VANELLUS, the LAPWING, in ornithology, the black-breaſted tringa, with a hanging creſt.

This ſpecies is about the ſize of the common pigeon; the head is ſmall, but very beautiful, a little depreſſed on the crown, but not at all on the ſides; the eyes are bright and piercing; the head is elegantly variegated, and is ornamented with a beautiful creſt hanging over the hinder part of the neck.

VANES, on mathematical inſtruments, are ſights made to move and ſlide upon croſs-ſtaves, fore-ſtaves, quadrants, &c.

VANILLA, or VANELLOE, in commerce, implies the fruit of a climbing plant growing in many parts of the Spaniſh Weſt-Indies. It is a long flattiſh pod, containing under a wrinkled brittle ſhell, a reddiſh brown pulp with ſmall ſhining black ſeeds.

Vanelloes have an unctuous aromatic taſte, and a fragrant ſmell like that of ſome of the balſams heightened with muſk. They are uſed chiefly in perfumes; ſcarcely ever, among us at leaſt, in any medicinal intention. They often make a part in the compoſition of chocolate, to give it an agreeable flavour.

VAPOR, or VAPOUR, in metreology, a thin viſicle of water, or other humid matter, which aſcends to a certain

certain height in the atmoſphere, where it is ſuſpended till it returns in the form of rain, hail, ſnow, or the like.

An aſſemblage or number of particles, or veſſicles of vapour, conſtitutes what we call a cloud.

The ingenious Dr. Hamilton, profeſſor of philoſophy in the univerſity of Dublin, has explained the aſcent of watry vapours, and other phænomena of the atmoſphere, on a principle very different from any that has hitherto been uſed on this occaſion; and removed the difficulties which before attended this difficult, and intereſting enquiry. We ſhall therefore lay before our readers the Doctor's account, which appeared in the *Philoſophical Tranſactions*, Vol. LIV.

"In all the accounts, ſays the doctor, I have met with, fire, or heat and rareſaction, by which watery vapours are ſuppoſed to become ſpecifically lighter than air, are made to be the principal, if not the only cauſes of their aſcent into the atmoſphere. Doctor Niewentyt, and ſome others ſuppoſed, that the particles of fire, by adhering to thoſe of water, make up moleculæ or ſmall bodies ſpecifically lighter than air. And Doctor Hally thought that by the action of heat the particles of water are formed into hollow ſpherules filled with a finer air, highly rarefied, ſo as to become ſpecifically lighter than the external air. This laſt was the opinion moſt commonly received as Doctor Deſaguliers tells us in his diſſertation on this ſubject (publiſhed in the *Philoſophical Tranſactions*, in the year 1729) in which he examines and refutes the two former opinions, and endeavours to eſtabliſh his own. He aſcribes the aſcent of aqueous vapours to their being turned into an elaſtic ſteam, and always rarefied more than the air by the degrees of heat, to which bodies are uſually ſubject in the different ſeaſons of the year.

"This opinion, I find, has been as ill received by ſubſequent writers, as the former ones. Mr. Clare, in his *Treatiſe on the Motion of Fluids*, has brought many objections againſt it; as Mr. Rowning has alſo done in his *Syſtem of Natural Philoſophy*, not long ſince publiſhed; who ſays, that the cauſe of the aſcent of vapours has been much diſputed, but not yet determined by philoſophers, and owns that he cannot think of any true principle of philoſophy upon which it may be accounted for.

"I ſhall not here repeat the objections made by thoſe gentlemen, but muſt beg leave to add the two following, which, among many others that might ſtill be urged, they have not taken notice of.

"Firſt, If heat was the only cauſe of evaporation, water in a cloſe room would evaporate faſter than when expoſed in a colder place where there is a conſtant current of air, which is contrary to experience.

"Secondly, The evaporation of water is ſo far from depending on its being rarefied by heat, that it is carried on even whilſt water is condenſed by the coldneſs of the air. For water is gradually condenſed by cold, 'till the moment it freezes; and ſince it evaporates even when frozen into hard ice, it muſt evaporate in all the leſſer degrees of cold. Mr. Boyle having counterpoiſed a piece of ice in a ſcale, hung it out in a froſty night, and found next morning that it loſt conſiderably of its weight by evaporation, "Who would have thought, ſays he, that "ſo extremely hard and cold a body would evaporate "ſo faſt in the clear air of a freezing night?" and ſince that time others have obſerved the ſame thing; which fact ſeems to be an unanſwerable objection to all the accounts in which rareſaction by heat is made to be the chief, if not the only cauſe of evaporation; and therefore we muſt have recourſe to ſome other principle to aſſiſt us in accounting for this phænomenon.

"As the author of nature does not employ in his works a greater variety of cauſes than is abſolutely neceſſary, it is the buſineſs of natural philoſophy to reduce as many phænomena as may be, to ſome general well-known cauſe; and this is to be done by comparing the phænomena together in their ſeveral circumſtances, in which if they are found to agree, they are then to be conſidered as effects of the ſame kind, and aſcribed to the ſame cauſe; by which means, the cauſes, whoſe exiſtence is already proved, will be rendered more general, and our knowledge more extenſive. Now, as the ſuſpenſion of the particles of water in air, of ſalt in the waters of the ocean, and of other heavy bodies in the fluids that diſſolve them, ſeem to be phænomena of the ſame kind, we might reaſonably ſuppoſe, that they ariſe from the ſame cauſe, and that what we call evaporation is nothing more than a gradual ſolution of water in air. But that I may not propoſe this merely as an hypotheſis, I ſhall endeavour to prove the truth of it, by conſidering the nature of ſolution in general and comparing its properties and effects with thoſe of evaporation.

"By ſolution we underſtand, ſuch an intimate union between the particles of a body and thoſe of a fluid, that the whole ſhall appear an homogeneous maſs, as tranſparent as the fluid was before ſuch union, and ſhall ſo continue, till ſome external cauſe produces a change. The nature of ſolution has been explained by the writers on chymiſtry in this manner; when the particles of any body ſurrounded by a fluid are leſs ſtrongly attracted by each other than by the fluid, they muſt ſeparate from each other, and join themſelves to thoſe of the fluid, and remain ſuſpended therein: thus various ſalts are diſſolved in water, eſſential oils in ſpirits of wine, gold in aqua regia, mercury, ſilver and other metals in other acid ſpirits; and indeed it ſeems to be with great appearance of reaſon, that the attraction between the minute particles of different bodies (of which we have ſo many other inſtances) is aſſigned as the cauſe of that union between them, which we experience in ſolutions; the chief properties of which I ſhall now mention, ſo far as may be neceſſary for the purpoſe, to which I mean to apply them.

"In moſt caſes a diſſolving fluid, or menſtruum as chymiſts call it, will diſſolve or take up only a certain proportion of the body immerſed, and if then any more of the ſame body be added, it will precipitate, or fall to the bottom, and then the fluid is ſaid to be ſaturated with the body it has diſſolved; yet a fluid which is ſaturated with one body may afterwards diſſolve others of different kinds, and keep all their particles ſuſpended together.

"When any menſtruum has entirely diſſolved a body, it will continue as tranſparent as it was before; the cauſe of which may be aſſigned from what Sir Iſaac Newton diſcovered by experiments, viz. that the particles of bodies muſt be of a certain ſize or bigneſs to cauſe any reflection or refraction of the rays of light at their ſurfaces to which opacity is owing; whence he gives the reaſon, why ſome bodies are opaque and others tranſparent. He alſo obſerves, that the moſt opaque bodies (ſuch as metals) being diſſolved in an acid menſtruum, and thereby reduced to their ultimate and ſmalleſt particles, do not take away the tranſparency of the menſtruum.

"Hence we may always know how to diſtinguiſh a ſolution from a mixture. For, if a body be reduced to powder and thrown into a fluid that will diſſolve it, and they are then ſhaken ſuddenly together, the fluid will continue ſomewhat opaque, till the ſolution be effected, or till what remains undiſſolved fall to the bottom; for in this caſe, the particles are not at firſt reduced to their ſmalleſt ſize, as they always are in a ſolution. I think therefore we may conſider the tranſparency of an heterogeneous fluid (or one that contains in it particles of another body) as the criterion of a true ſolution; and where that is wanting, it is only a mixture; as when water and air appear together in froth, or in a cloud, or a thick miſt, it is only a mixture of thoſe bodies, and not a ſolution of one in the other.

"This much being premiſed concerning the nature of ſolutions in general, I proceed to the proof of what I propoſed; and in order to this, I ſhall ſhew that there is a mutual attraction between water and air, the ſame that we obſerve between the particles of any two bodies, one of which diſſolves the other. I ſhall then compare in ſeveral inſtances, the properties and effects of common ſolutions with thoſe of evaporation; that from the exact reſemblance between theſe two phænomena, it may appear that they are natural operations or effects of

a like kind, and therefore to be explained upon the ſame principle, or aſcribed to the ſame cauſe. Thence I ſhall ſhew, how the aſcent of vapours, and ſeveral other phænomena of the atmoſphere may be accounted for. And laſtly, I ſhall add ſomething on the riſing of ſteam from boiling liquors, and ſhew wherein it differs from common evaporation.

"I am firſt to prove that there is an attraction between the particles of air and water. It is well known, that all water contains a conſiderable quantity of air, that retains its elaſticity by means of which it may be ſeparated from the water by boiling and including it in an exhauſted receiver. And it has been proved by experiments, that air extricated from water by boiling, and reſtored to its uſual denſity, will occupy a ſpace greater than that poſſeſſed by the water in which it was contained. Now ſince it is allowed that the particles of ſo heavy a body as gold are ſuſpended in aqua regia by their attraction towards the particles of that fluid, it ſeems reaſonable to ſuppoſe, that ſo light and elaſtic a body as air muſt be retained under water by a like force, without which it would always aſcend to the ſurface and eſcape. But that there is really ſuch an attractive force between air and water, has been fully proved by the following experiment.

"Let an oil-flaſk be filled almoſt full with water, deprived of its air, as much as may be; let the mouth of it be then ſtopped, until the neck being inverted is immerſed in a veſſel of water; a bubble of air will then aſcend into the upper part of the flaſk. When things have ſtood in this way for ſome days, the water will be found to have abſorbed the whole bubble of air (if it was not too large) and entirely filled the flaſk. But if the bubble was too large, part of it will be left; for the water, after ſome time, will abſorb no more air, being then ſufficiently ſaturated with it. It is obſervable that a part of the included air enters pretty quickly into the water at firſt, but what remains afterwards makes its way in but very ſlowly. This experiment ſhews that water, when deprived of its air, will again draw the air gradually into its pores; juſt in the ſame manner as a lump of dry ſugar will draw up water into its pores, which will aſcend pretty quickly at firſt, but very ſlowly after ſome time. We have reaſon therefore to conclude, that there is the ſame kind of attraction between air and water, that there is between water and any dry porous body that will imbibe it.

"As water contains a conſiderable quantity of air, ſo does air contain a good deal of water, even when we think it quite pure and dry; as appears from the moiſture drawn from it by dry ſalt of tartar, in ſuch quantity as to make the ſalt become entirely fluid. Now ſince the air is an heterogeneous fluid containing in it particles of another body, and yet retaining a perfect tranſparency, which is the criterion of a true ſolution in other caſes; why ſhould we not infer from analogy, that in this caſe alſo there is a true ſolution of water in air.

"But the truth of this will be confirmed by farther comparing the properties of common ſolutions with thoſe of evaporation; which I ſhall now do in ſeveral inſtances.

"Firſt; when a body is immerſed in a fluid that diſſolves it, for inſtance a lump of ſalt in water, we ſee the ſalt ſoon begin to diſſolve, and impregnate with its particles the water that ſurrounds it, which will then appear thick and loaded, and if the water be at reſt the ſolution will proceed very ſlowly; but if it be ſtirred about, the ſalt will ſoon be entirely diſſolved. How exactly does this correſpond with what Dr. Halley remarked in an experiment he made on the evaporation of water in a cloſe room? (*Philoſ. Tranſ.* N°. 192.) "The ſame obſervations ſays he, do likewiſe ſhew an "odd quality in the vapours of water, which is, that "of adhering to the ſurface that exhales them, which "they clothe as it were with a fleece of vapourous "air, which once inveſting it, the vapour riſes afterwards "in much leſs quantity." Here we ſee, that the air which lay at reſt over the water appeared thick and loaded with the aqueous particles, and then the evaporation proceeded very ſlowly; juſt as the water that lies about the ſalt, appears thick and loaded, and while it continues at reſt, the ſalt is diſſolved but ſlowly. He alſo obſerves on the ſame occaſion, that evaporation is vaſtly promoted by a current of freſh air paſſing over the exhaling ſurface: and this I have no doubt happens for the ſame reaſon that ſolution is greatly promoted by agitation, which continually brings freſh particles of the fluid into contact with the body it diſſolves, in the place of thoſe that have been already ſaturated.

"Secondly; into a glaſs of clear cold water throw a lump of any ſalt which is ſoluble in it, and when it has ſtood a little time, ſhake the glaſs or ſtir the water very gently, and the water which is ſaturated with the ſalt will riſe up among the reſt of the water in curled wreaths or long ſtriæ, which will render the water ſomewhat opake, cauſing it to refract in different directions the light of an object ſeen through it, and will make the object appear to have a tremulous motion; this will continue until all parts of the water are equally impregnated with the ſalt, and then its tranſparency will be reſtored. As the parts of the water which are impregnated with the ſalt are of different denſities from the reſt, while they are mixing together, they muſt occaſion thoſe refractions and this apparent tremulous motion, which will ceaſe as ſoon as all the water becomes of the ſame denſity. The very ſame appearances will attend the mixing together of any two fluids of different denſities, and which will thoroughly incorporate with each other.

"In like manner, when ſmoke or ſteam, iſſuing from the pipe of a boiliug veſſel, firſt riſes into the air, it appears in curled wreaths and renders the air opaque; but as ſoon as it is entirely diſperſed, the tranſparency is reſtored. Thus alſo in a calm, hot, ſun-ſhine day, when we look along a moiſt piece of ground, the air and any object ſeen through it appear to have a tremulous motion, like that which we obſerve in an object, ſeen thro' two fluids which are mixing together. Now, as the vapours riſe here in great abundance and the air has but little motion, thoſe parts of it that are much impregnated with aqueous particles are mixed gradually with the air that is drier and of a different denſity; which will occaſion refractions of the light, and that apparent tremulous motion, juſt now mentioned; and in this caſe, the ſolution of water in air (if I may yet venture to call it by that name) is carried on in a manner viſible to the eye, as ſolutions are in other fluids. The ſame tremulous undulating motion is more obſervable, when we look in warm weather through a teleſcope, which magnifies the vapours floating in the air: and from this kind of refraction the twinkling of the ſtars ſeems to ariſe; with this difference only, that the watery refracting particles in the day-time are paſſing into a ſtate of ſolution, whereas the vapours already diſſolved are by the cold of the night beginning to precipitate, and return into particles large enough to cauſe refractions in the light of the ſtars.

"Thirdly; heat promotes, and cold in ſome meaſure ſtops or checks both ſolution and evaporation. Very hot water will diſſolve ſalt ſooner and in a greater quantity than cold water; and if a ſtrong ſolution of ſalt be made in hot water, the water when cold will let go ſome of the ſalt before diſſolved, which will fall to the bottom in ſmall particles or ſhoot into chryſtals. Juſt ſo will water evaporate faſter in warm than in cold air; and the aqueous vapours ſuſpended in the air during the heat of the day, fall down at night and form themſelves into drops of dew, or if the night be very cold appear next morning chryſtalized in a hoar-froſt. And thus if in a hot day a bottle be filled with any very cold liquor, and expoſed to the warm air, which to us ſeems very dry, a dew will be ſoon formed on the outſide of the bottle; for the air about it becoming cold will let go part of its moiſture, which will be attracted to the ſurface of the glaſs; for the ſame reaſon a dew is formed on the inſide of the windows of a warm room which on their outſide are expoſed to the cold air. Hence alſo we may obſerve, that as there cannot be ſo continual and copious an evaporation in cold weather, the air will then be generally clearer than it is in hot weather.

"Heat ſeems to promote ſolution, becauſe it expands bodies, and thereby enlarges their pores, and leſſens the coheſive attraction of their particles; ſo that a body, when

when hot, will more eaſily admit a diſſolving fluid into its pores, and its particles not cohering together ſo ſtrongly, as when cold, will more readily quit each other, and unite themſelves to the particles of the fluid by which they are attracted; and for the ſame reaſon heat will alſo promote the evaporation of fluids.

"But fourthly; The quantity of a body diſſolved, and of a fluid evaporated, in a given time, depends (*cæteris paribus*) on its quantity of ſurface. Thus a body reduced to powder is ſooner diſſolved than when it is in a ſolid form; and thus ſmoak or ſteam (which is water reduced to very ſmall particles by heat) is much ſooner diſperſed and incorporated with air, than water in its uſual form.

"Fifthly; chymiſts obſerve, that when ſea-ſalt ſal ammoniac, or nitre, is diſſolved in water, or eſſential oils in ſpirit of wine, ſome degree of cold is produced in the immediate act of ſolution; and the quicker the ſolution, the greater is the cold. By diſſolving pounded ice, or rather ſnow (whoſe particles have a greater ſurface) in ſpirit of nitre, a degree of cold has been produced ſo great as to freeze quick-ſilver. Cold is likewiſe produced in the act of evaporation. For if ſpirit of wine, or æther, having the ſame temperature with the air, be rubbed lightly with a feather over the ball of a thermometer, it will ſink as the ſpirit evaporate; and the quicker they evaporate, the faſter will the thermometer ſink; thus I have made water freeze in a thin glaſs merely by the evaporation of æther promoted by a current of air. Water will likewiſe produce cold, if it be uſed inſtead of ſpirits, provided its evaporation be promoted by a ſtrong current of air. That cold is produced by the evaporation of water appears from the practice of ſailors, who, in hot climates, cool their liquors by wrapping the veſſels in wet cloths, and hanging them up where they are much expoſed to the wind and ſun, and wetting the cloths again when they become dry.

"This obſervation ſhews a very remarkable agreement between the natures of ſolution and evaporation: How the cold is produced in either caſe, I cannot pretend to ſay; but I muſt beg leave juſt to apply this fact, to account for a thing which I believe moſt people have taken notice of. If we rub Hungary-water, or any other volatile ſpirit over our hand, it will feel much colder than water, though they be both of the ſame temperature, and will both feel equally cold, if we dip our finger into each. The reaſon of which is, that the ſpirit evaporating much quicker than the water, produces thereby a greater degree of cold. And ſo æther, if it be applied in the ſame way, will feel colder than any other ſpirit, on account of its more ſudden evaporation.

"Sixthly; it is known, that rectified ſpirit of wine, when purged of air, will imbibe a large bubble of air in a much ſhorter time than water will do, and I have myſelf experienced the truth of this, which ſhews that there is a ſtronger attraction, or affinity (as the chymiſts call it) between ſpirit of wine and air, than between water and air, and ſince the ſpirit evaporates much faſter than the water, I think we may conclude from hence, that the evaporation of fluids ariſes from an attractive force between their particles and thoſe of air. But here it muſt be obſerved that the ſpirit is not only more ſtrongly attracted by the air than water is, but, being alſo more eaſily rarefied by heat, its particles ſeem to cohere together more ſlightly than thoſe of water, and therefore may be more eaſily ſeparated by the attraction of the air.

"Seventhly; if into any menſtruum we throw a body, which it diſſolves, and afterwards add another, to which the menſtruum has a greater affinity than it has to the firſt, it will diſſolve the ſecond body, and let go the firſt, which will be precipitated and fall to the bottom. In the very ſame manner will a fluid let go the air it contains, upon the addition of another body to which it has a greater affinity than it has to the air. Thus if to well rectified ſpirit of wine we add an equal quantity of clear water, theſe fluids (which ſo readily incorporate) having a greater affinity to each other than to the air they contain, will let go a great part of that air, which will riſe to the top, or adhere in ſmall bubbles to the ſides of the veſſel. This, I think, ſhews that air is contained in theſe fluids, in the ſame manner that the particles of a body are contained in a menſtruum that diſſolves it; and hence I conclude that the air which is imbibed by any fluid is, properly ſpeaking, diſſolved in that fluid; and conſequently that any fluid which avaporates, or is imbibed by the air, is alſo, properly ſpeaking, diſſolved in air. Upon this principle we may ſay, that water is drawn out of the air by dry ſalt of tartar, from its having a greater affinity to that ſalt than to the air.

"I ſhould not have been ſo tedious in comparing together the natures of ſolution and evaporation in ſo many inſtances, but that it gave me an opportunity at the ſame time of explaining ſome of the phænomena that I at firſt intended to conſider; which explanations I believe will be admitted, if I am right in the main point I have endeavoured to prove. And really when we conſider how exactly ſolution and evaporation agree, in their ſeveral appearances, properties and effects, I think we muſt be convinced that they are natural operations of the ſame kind, and that what we call evaporation, is nothing more than a gradual ſolution of water in air, produced and promoted by the ſame means (to wit) attraction, heat, and motion, by which other ſolutions are effected.

"I ſhall now endeavour to account for ſeveral phænomena of the atmoſphere upon this principle, which will be ſtill further confirmed, if it be found to anſwer the purpoſe to which it is applied.

"The loweſt part of the air being preſſed by the weight of the atmoſphere againſt the ſurface of the water, and continually rubbing upon it by its motion, has thereby an opportunity of attracting and diſſolving thoſe particles with which it is in contact, and ſeparating them from the reſt of the water. And ſince the cauſe of ſolution in this caſe is the ſtronger attraction of the particles of water towards the air, than towards each other, thoſe that are already diſſolved and taken up, will be ſtill further raiſed by the attraction of the dry air which lies over them, and thus will diffuſe themſelves, riſing gradually higher and higher, and thereby leave the loweſt air not ſo much ſaturated, but that it will be ſtill able to diſſolve and take up freſh particles of water. And thus ice or ſnow will evaporate as well as water, its particles being attracted and diſſolved by the air, which is ſtrongly preſſed againſt its ſurface; for though heat promotes both ſolution and evaporation, yet we do not find that in either caſe any ſenſible degree of it abſolutely neceſſary.

"In this manner will aqueous vapours aſcend ſlowly into the atmoſphere, even when we ſuppoſe the air almoſt at reſt, for I believe it is never perfectly ſo. But the ſolution of water in air, and the aſcent of vapours, is greatly promoted by the motion of the winds, which bring freſh and drier air into the place of that, which may be already ſaturated and loaded with moiſture, carrying it, together with its moiſture, into the higher parts of the atmoſphere and diſperſing it into all quarters.

"If we ſhould now ſuppoſe the atmoſphere to remain always of the ſame temperature as to heat and cold, and to have always the ſame denſity; when it was once ſaturated with water, all evaporation would ceaſe, and the vapours already raiſed would always remain ſuſpended; for a fluid, while it remains of the ſame temperature and denſity, will never let go the particles of a body that it has diſſolved. We muſt therefore conſider what are the cauſes which occaſion the air ſometimes to part with the water it has diſſolved, and which thereby keep up a continual circulation of vapours; and theſe I ſhall ſhew to be the frequent viciſſitudes of heat and cold, condenſation and rareſaction, to which the atmoſphere is ſubject.

"As to the effects of heat and cold, I have already ſhewn that the former promotes, and the latter checks or in ſome meaſure hinders evaporation as well as other ſolution; of which I gave an inſtance in the vapours that are ſuſpended in the heat of the day, and by the cold of the night are precitated and ſuffered to coaleſce into drops of dew. From the ſnow that lies ſo long on the

the tops of mountains, and from the experience of thoſe who have paſſed over them, we find that the higher parts of the atmoſphere are much colder than the lower. Now though vapours are firſt raiſed, and abound moſt in the lower parts of the atmoſphere, yet they cannot there form themſelves into clouds, becauſe the heat that helped to diſſolved them, helps alſo to keep them diſſolved. But when they are carried by the winds into the higher parts, where the ſame heat is wanting, the cold air will not be able to keep diſſolved all that are carried up, but muſt ſuffer ſome of them to coaleſce into ſmall particles, which ſlightly attracting each other and being intermixed with air will form clouds, having the very ſame appearance with ſteam or ſmoke, which alſo conſiſts of ſmall particles of water mixed with air and not yet diſſolved in it. Theſe clouds when firſt formed will remain ſuſpended, though they conſiſt of water, as well as air; becauſe the weight of their particles will not be able to overcome the reſiſtance they muſt meet with in deſcending through the air. For when bodies are diminiſhed, their quantities of matter, to which their weights are proportional, decreaſe faſter, or in a greater ratio, than their ſurfaces to which the reſiſtence they meet with is proportional, and therefore in very ſmall particles, this reſiſtance may become greater than their weight. The different heights at which clouds are formed, depends on the quantity of vapours carried up, and the degrees of heat in the upper parts of the atmoſphere; for the vapours may always aſcend 'till they meet with air ſo cold or ſo thin that it is not able to keep diſſolved all that are carried up; hence clouds are generally higher in ſummer than in winter. When clouds are much increaſed by a continual addition of vapours, and their particles are driven cloſe together by the force of the winds, they will run into drops heavy enough to fall down in rain. Sometimes the clouds are frozen before their particles are gathered into drops, and then ſmall pieces of them, being condenſed and made heavier by the cold, fall down in thin flakes of ſnow, which appear to be fragments of a frozen cloud; but if the particles be formed into drops, before they are frozen they become hail-ſtones.

"When the air is replete with vapours; and a cold breeze ſprings up, which it often does from the ſea, the ſolution of theſe vapours is checked, and clouds are formed in the lower parts of the atmoſphere, and compoſe what we call a miſt or fog. This generally happens in a cold morning, but when the ſun has been up for ſome time, the warm air again diſſolves thoſe watery particles, and it frequently clears up. In a hot ſummer's day the air lying over wet marſhy ground is copiouſly filled with aqueous vapours, but the air growing cooler after ſun-ſet, will not be able to keep all thoſe vapours diſſolved, but muſt let ſome part of them unite quickly into very ſmall viſible particles, and form thoſe miſts which appear to riſe from marſhy grounds in a ſummer's evening. The vapours near the ground being more denſe and copious, will he firſt affected by the cold, and afterwards thoſe that are thinner and higher up, ſo that the miſt will be low at firſt, but will encreaſe in height afterwards. But beſides, theſe grounds and the water they contain will acquire ſuch a heat from the ſun that they may retain it for ſome time, and communicate it to the contiguous air, ſo that the vapours may continue to riſe for ſometime after ſun-ſet, and will become viſible when they get up a little way into the cooler air. After a warm and unclouded day in ſummer there falls abundance of dew, and the air ſcarce recovers its clearneſs 'till towards morning, when it is pretty much cooled; but on the firſt return of heat, at ſun riſe or a little before it, the water, which is then plentifully ſpread over the ground and the leaves of trees and plants in very ſmall drops, begins again to diſſolve, and while it is diſſolving occaſion that hazineſs ſo obſervable in a hot ſummer's morning about ſun-riſe and for ſome time after. Here it may be proper to obſerve, that when the particles of water are of a certain ſize, they will render the air equally opaque, whether they are paſſing into a ſtate of ſolution, or returning from it.

"Thoſe cold thick morning fogs I mentioned juſt now are often attended with a very light ſmall rain; for the vapours are then returning faſt from a ſtate of ſolution, and we ſee the drops at their firſt formation, and they are ſuch as we generally meet with in paſſing over high mountains. So that it ſeems the drops of rain are very ſmall when firſt formed in the clouds; but being driven about by the motion of the air in their deſcent, ſome of them will probably touch each other and run into a drop of a larger ſize, and the farther they have to fall, the more will their ſize be encreaſed before they come to the ground. And for this reaſon, the drops which fall from the higher clouds in ſummer are found to be generally larger than they are in winter, when the clouds are low. It has been likewiſe obſerved that the drops of rain are remarkably large that fall in ſudden thunder-ſhowers; of which the reaſon may be, that the lightning burſting from a cloud and expanding itſelf greatly, will ſuddenly remove the air from its place, which air muſt therefore return to its place with great violence, and thereby the watery particles in the clouds will be ſtrongly agitated and driven againſt each other, by which means they will form themſelves into larger drops than at other times. Or perhaps it may be ſaid, that when a cloud is filled with lightning, which is the ſame as the electric matter, the watery particles like other electrified bodies, will repel each other, but being ſuddenly deprived of this repelling matter, will by their mutual attraction come together again with ſome velocity, and therefore will run into drops larger than uſual.

"When the wind blows from the ſouth, it is generally warm and comes replete with aqueous vapours which it has diſſolved, but coming into a colder climate it cannot there keep the ſame quantity of vapours diſſolved that it did before, and conſequently muſt part with ſome of them and let them precipitate; and therefore ſoutherly winds generally bring us rain. On the other hand, when the wind blows from the north, or any point near it, as it is very cold it cannot have diſſolved a great deal of aqueous vapours where it came from, and therefore coming into a warmer climate it is ready to diſſolve more. And on this account theſe winds, if they continue long, are found to be very dry and parching, and are generally attended with fair weather.

"Theſe ſeem to be the effects of heat and cold, as far as the different temperatures of the air will occaſion it to diſſolve and take up, or let go and precipitate the aqueous vapours, in conſequence of which we ſometimes perceive changes of the weather, even when there is no change in the height of the barometer.

"But condenſation and rarefaction will alſo have the like effects in promoting the ſolution of water in air, or in occaſioning ſome part of what has been diſſolved to return again into water and precipitate. It ſeems reaſonable to ſuppoſe, that denſe air in which the particles lie very near each other, will be better able to diſſolve and keep ſuſpended a quantity of water, than the ſame air when diffuſed through a greater ſpace. And that this is really ſo, we have an experimental proof. For when a receiver is partly exhauſted, we ſee the rarefied air begin to let go the water it contained, which gathering into ſmall particles appears like ſteam or ſmoke falling to the bottom. In order to prove the ſame thing by other expriments, when a cup of water or rather of ſpirit of wine (which evaporates faſter) had ſtood for ſometime in a cloſe receiver full of air, I rarefied this air ſuddenly, by letting it ruſh into another receiver that was exhauſted, and immediately the vapour that was before ſuſpended gathered into ſmall particles and fell down in a very viſible ſhower. I alſo took from the air-pump a large exhauſted receiver 20 inches long, having at the bottom a braſs plate, with a ſtop-cock in the mid- of it, when the ſtop-cock was opened, the external air ruſhing in violently, and being much rarefied, let go the water it contained, and threw it againſt the other end of the receiver, where it ſtruck on the glaſs, and covered it with a thin dew, which I found to encreaſe until the receiver was almoſt full of air.

"Theſe experiments prove, that air when rarefied, cannot keep as much water diſſolved as it does in a more condenſed ſtate. And hence we muſt conlude, that when the atmoſphere is ſaturated with water, and changes

from

from a denſer to a rarer ſtate, the higher and colder parts parts of it eſpecially will begin to let go ſome of the water before diſſolved; which will form new clouds or add to the ſize or number of the particles before formed, and thereby render them more apt to fall down in rain. On the contrary, when the atmoſphere changes from a rarer to a denſer ſtate, it will then be able to ſtop the precipitation of the water and again diſſolve in the whole, or in part, ſome of thoſe clouds that were formed before, and conſequently will render their particles leſs apt to run into drops and fall down in rain. And thus we generally find by experience, that the rarefied and condenſed ſtates of the atmoſphere are reſpectively attended with rain or fair weather. Though this does not happen at all times, for the air, though rarefied, may not then abound much with aqueous vapours, having already parted with a good deal of them. So likewiſe when the air is denſe and heavy it may then be much loaded with aqueous vapours, which will encreaſe its weight, (and indeed it muſt be ſo after a long continuance of fair weather) and we may then have rain even before we can perceive by the barometer, that the atmoſphere changes to a rarer ſtate.

"Upon this principle, I think we may account for the changes of the weather, which uſually, attend the riſing and falling of the mercury in the barometer, better than by ſaying, that when the air grows rarer and lighter, it cannot by the laws of hydroſticks ſo well ſupport the clouds and vapours, and therefore muſt permit them to fall down in drops of rain. For when the air grows rarer, although the clouds will deſcend into a lower and denſer part of it, yet they will be there ſupported, and I do not ſee why their particles ſhould be more apt to run into drops there, than when they were higher up, unleſs they receive ſome addition from the water depoſited among them by the rarefied air, in the manner I have juſt now mentioned. For ſince the air is rarefied gradually, the clouds can deſcend but very ſlowly, and therefore their particles will not be ſo much preſſed together by the reſiſtance they meet with in their deſcent, as they generally are by the winds which blow upon them.

"When the atmoſphere is ſatutated with water, and grows colder and rarer than it was before, we ſhall then perceive the lower air begin to part with ſome of the water it contains, which will fall inſenſibly to the ground, or adhere to the walls of houſes, or other bodies expoſed to it, and make them become damp or wet. And if the moiſture ſettles on the ſmooth ſurfaces of cold bodies, ſuch as marble or other ſtones, whoſe pores cannot imbibe it, it will cover them with a kind of dew, and then thoſe bodies are vulgarly ſaid to ſweat. At this time the hygrometer being affected by the moiſture will point to wet, and as we perceive from thence, that the air is diſpoſed to part with the water it contains, we may generally expect rain. But when the air again grows warm or denſe, it will be able again to diſſolve and take up the water it before depoſited, and the moiſture on the bodies expoſed to it will diſappear, the hygrometer will point to dry, and we may then promiſe ourſelves fair weather.

"I obſerved before that if a bottle be filled with a very cold liquor, and expoſed to warm air, a dew will ſoon be formed on its ſurface, by the moiſture which the cooled air depoſits. Now if we ſuppoſe this body ſtill to retain the ſame degree of cold whilſt the air paſſes over it, the dew on its ſurface will continually encreaſe and run down its ſides in ſmall ſtreams of water. This ſeems to be exactly the caſe of mountains whoſe tops reach into the colder parts of the atmoſphere, and which therefore are themſelves colder than the air in general. For when the wind blows the lower parts of the atmoſphere, which are the warmeſt and moſt replete with vapours, againſt the ſides of the mountains, it being there ſtopped in its courſe, muſt neceſſarily aſcend and paſs over their tops; this air will therefore be conſiderably cooled in its progreſs up the ſides and over the tops of the mountains, and conſequently muſt let go a great part of the watery vapours it contains; which will be precipitated in dew and moiſture, upon the ſurface of the mountains, where it will ſink into the earthy parts, or inſinuate itſelf into the chinks and crevices of rocks, and being there collected will afterwards break out in ſprings and fountains, and become the ſource of rivers, which are known to take their riſe in mountainous countries. And on this account we might have ſmall ſprings and rivers near mountains tho' there were neither clouds nor rain. But the moiſture which the air uſually depoſits on the mountains muſt be conſiderably encreaſed by the clouds which are driven againſt them, and accumulated by the winds, for their particles being then preſſed together will run into ſmall drops of rain. Beſides, it is well known that mountains gather and retain the clouds about them by their attraction, in conſequence of which we often ſee ſome clouds continue at reſt on the mountains, whilſt the others are carried on gently by the wind. Hence it is that countries in the neighbourhood of high mountains are the moſt ſubject to frequent rains.

"Thus I have ſhewn how the aſcent of aqueous vapours and their conſtant circulation, by precipitating again in moiſture and drops of rain, will ariſe from the diſſolving power of the air, influenced by the viciſſitudes of heat and cold, condenſation and rarefaction; which cauſes, as they take place in different degrees, will occaſion thoſe various ſtates of the atmoſphere in reſpect to dryneſs or moiſture which we experience in the ſeveral changes of the weather; to which the winds contribute very much by heating or cooling, condenſing or rarefying the different parts of the atmoſphere, and by promoting the ſolution of water in air, as they mix thoſe fluids together, or, when the air is already ſaturated with aqueous vapours, by preſſing together the particles in the clouds, and thereby cauſing them to run into drops.

"If we may thus, from the known properties of ſolutions, account in a ſatisfactory manner for the aſcent and circulation of aqueous vapours, and the ſeveral phænomena of the atmoſphere ariſing from thence; it muſt be a greater confirmation of the arguments brought to prove that evaporation is only a particular ſpecies of ſolution; and therefore that they both proceed from the ſame cauſe, viz. the attraction that obtains between the minute particles of different bodies, which is the means of carrying on ſo many other operations of nature.

"And indeed upon this principle, air ſeems better fitted to be a general ſolvent than any fluid we know of; becauſe its particles, not attracting each other, are more at liberty to unite themſelves to minute particles of ſuch bodies as they do attract. And accordingly we find the atmoſphere contains in it matter of all kinds. The odoriferous particles of bodies ſeem to be ſtrongly attracted by the air, as they are ſo very readily diſperſed through it; and camphor, which is a very light volatile body, may be entirely diſſolved in air without leaving any remainder. The air abounds with vitriolic and other acids, as is plain from the ruſting of iron expoſed to it. It abounds alſo with ſulphurous, nitrous, and other inflammable particles, as appears by the frequent meteors kindled in it. For we have many ſubſtances, ſuch as ſtrong acids and eſſential oils, which being thrown together will unite with ſuch violence as ſuddenly to burſt into a flame, and therefore when the particles of thoſe bodies, floating promiſcuouſly in the air, happen to come together in a ſufficient quantity by their mutual attraction, which we know is very ſtrong, they muſt kindle into a flame, and if many particles of the inflammable kind lie contiguous, the fire will run in a train and form, what we call, ſhooting ſtars, and other blazing meteors. In ſhort, the atmoſphere may be conſidered as a chaos containing particles of all ſorts of bodies; and as the great inſtrument of nature for keeping up a general circulation of matter; and by which not only water is every where diſperſed, but oftentimes the eggs of inſects and the ſeeds of plants are conveyed from place to place, both which have been found in rain-water, on examining it careſully juſt after it had fallen; and indeed we ſometimes find inſects and plants in ſome places where their appearance cannot well be accounted

accounted for, otherwiſe than by ſuppoſing their eggs and ſeeds to be conveyed thither by the air.

" I ſhall now mention two other inſtances in which this diſſolving power of the air produces effects of the utmoſt importance. Dr. Boerhaave, ſpeaking of that power or quality of air, which makes it neceſſary for the preſervation of animal life; calls it a certain hidden virtue, not to be accounted for from any of the properties of air then diſcovered. Perhaps we may be led to ſome knowledge of it, by conſidering on what account air may become unfit for reſpiration by paſſing two or three times through the lungs of an animal, for we find that an animal incloſed in ſuch air will ſoon expire. I think we may be ſure that one purpoſe, at leaſt, for which air was deſigned is, the carrying off that moiſture and other perſpirable matter which conſtantly exhales from the lungs, for this we know it actually does. Now as air loſes nothing of its elaſticity by paſſing thro' the lungs, an animal might ſtill continue to breathe the ſame air, and it would ſtill continue fit for all ſuch purpoſes in the animal oeconomy as may be anſwered by the alternate expanſion and contraction of the lungs in reſpiration. But this air muſt in a ſhort time become ſaturated with that moiſture and other perſpirable matter which it meets with in the lungs, and muſt then loſe its power of diſſolving and carrying off any more of that kind of matter; which nature intends ſhould be conſtantly diſcharged, and which will therefore continually encreaſe, and thereby oppreſs the lungs, heat the blood, or produce ſuch other noxious effects as are more immediately fatal than thoſe ariſing from the ſtoppage of external perſpiration. So that an animal incloſed in ſuch air cannot live long, and will perhaps die ſomewhat in the ſame manner as if it had been drowned. Whether the air we breathe may depoſite, in our lungs, any kind of matter neceſſary to the ſupport of life, I cannot pretend to judge, nor is it my deſign to enquire; what has been ſaid ſhews the neceſſity of freſh air in reſpiration, and by what property it is adapted to anſwer one very important purpoſe, and alſo how air may ſoon become unfit for that purpoſe. But here I will venture to aſk, whether it is not probable, that, in the conſtant and quick evaporation of moiſture from the lungs, ſome degree of cold may be produced, as in other evaporations, which, together with the freſh air taken in, may ſerve to cool the lungs, and the blood paſſing through them? We may ſee from hence that moiſt air muſt be very unwholeſome by its not ſufficiently promoting the neceſſary perſpiration both internal and external.

" Air is not leſs neceſſary for the ſupport of fire than of animal life; for fire will not long continue to burn without a circulation of air. Now I ſuppoſe this happens, not from its adding any thing to the pabulum of fire, for fire ſeems to be otherwiſe ſufficiently provided with pabulum, but rather on this account; that the air immediately about a body on fire is heated and made ſpecifically lighter than the air at ſome diſtance from it; this hot air muſt therefore aſcend, and carry with it all thoſe minute particles of different kinds which are thrown off from the burning body, and which would otherwiſe reſt upon its ſurface, and thereby clog and ſtop the ſubtile vibrations of the burning matter, in which the nature of fire partly conſiſts. If therefore fire be confined in a cloſe place where there can be no circulation of freſh air, the air about it being ſoon ſaturated with the particles ariſing from the burning matter, will not be able to take up any more of them, and therefore the fire muſt go out, ſmothered as it were with ſuch particles as are no longer combuſtible. And hence it is that fire burns faſter when air is ſtrongly blown upon it, for then the aſhes are carried off as faſt as they are formed on the ſurface of the burning body, and thereby the particles that have juſt taken fire are kept quite free from any thing that can impede and clog their vibratory motion. The air in this caſe will alſo ſpread the fire quickly through the fuel by blowing the particles that are already kindled among thoſe that are not; and perhaps the motion of the air in this caſe may promote the ſubtile vibrations in the burning matter by which the fire is propagated through its parts.

" To this general obſervation, that air is neceſſary for the ſupport of fire, we muſt admit one exception; for nitre will burn in a cloſe veſſel, or in vacuo. The cauſe of this ſingular phænomenon I ſhall endeavour to aſſign from what has been ſaid. Nitre, when ſet on fire, burns with more rapidity and violence than any body we know of; its burning is a kind of exploſion, and produces a very fierce and elaſtic flame; for which reaſon it is a neceſſary ingredient in gun powder, pulvis fulminans, and all other fulminating compounds. When therefore a piece of nitre takes fire, its claſtic flame drives off the fumes and vapours, with which the air in the veſſel may be then ſaturated, and defends the burning matter, ſo that they cannot ſettle upon it and extinguiſh it, as they do other bodies that burn ſlowly and without any exploſion. And on this account nitre, and other inflammable matter mixed with it, will burn in cloſe veſſels or even in vacuo. This will further appear from conſidering the manner in which nitre firſt takes fire, and the reaſon of its exploding quality. Nitre will not burn by itſelf though melted and made red-hot; but when it comes in contact with any body actually on fire, and which therefore contains an inflammable matter, or, as it is called, the phlogiſton, it burſts into a flame. Here the chymiſts ſay, that the acid ſpirit of the nitre unites ſo rapidly with the phlogiſton, which is detached from the burning matter, that by the violence of their congreſs they both vaniſh together in a flame. And they prove this to be ſo, by throwing ſtrong acid of nitre on any thick eſſential oil, which conſiſts almoſt wholly of the phlogiſton, for then the mixture will ſuddenly burſt into a flame with a violent exploſion. Therefore ſo long as nitre and the inflammable matter are thus in contact, no fumes or vapours floating about them can prevent that rapid union between their parts which muſt neceſſarily make them continue to burn. The air, which is produced from burning nitre, may poſſibly add to the elaſticity of its flame. But I do not think it probable that this air can contribute much to keep a large quantity of nitre burning ſo long as it will do in a cloſe veſſel.

" Having thus ſhewn by what property air produces the evaporation of fluids and ſeveral other effects, I come now to treat of thoſe vapours, that are raiſed merely by heat. Although the particles of fluids in common evaporation are raiſed into the atmoſphere by the attracting and diſſolving power of the air, yet in ſome particular caſes vapours will riſe into the air on another account. For in ſome places the earth often ſends forth hot elaſtic vapours that riſe into the air by means of their elaſticity, and carry up with them mineral and foſſile particles of different kinds. Fermentation generates elaſtic vapours, which expand themſelves into the air. And the particles of water and other fluids, when ſufficiently heated, acquire a repelling force which ſeparates them from the ſurface, and throws them upwards into the air. But all theſe vapours ſoon loſe that elaſticity by which they were at firſt raiſed, and they muſt then be retained and kept ſuſpended in the air by the ſame power that keeps up all the vapours that riſe without any elaſticity in common evaporation.

" That the particles of ſteam which riſe from hot water are endued with a repelling force, appears plainly when water is boiled in a cloſe veſſel; for then the ſteam becomes ſo exceedingly elaſtic that, unleſs proper care be taken, it will burſt the ſtrongeſt veſſel. In this caſe the boiling water, being ſtrongly preſſed by the force of the included ſteam, conceives a much greater heat than it will ever do in an open veſſel; for even when water is boiled in the open air, it is ſomewhat hotter when the atmoſphere is heavy, than when it is light, which ſhews that preſſure upon boiling water encreaſes its heat; the reaſon of which we may perhaps ſee preſently. But the moſt remarkable phænomenon that attends the boiling of water, is the large bubbles which continue to riſe from the bottom ſo long as the water boils, and long after all the air is driven out of it, of the nature of which there have been various opinions. Doctor Boerhaave, in his Elements of Chymiſtry, proves by ſeveral arguments, that theſe bubbles do not ariſe from air, and with regard to

their production, he ſeems to be of the ſame opinion with Stairs (to whoſe work he refers) that they ariſe from ſome active fires reſiding in the water. Marriotte, whom he alſo mentions on this occaſion, calls theſe bubbles fulminations, and ſuppoſes that they may proceed from ſome kind of ſaline particles contained in the water, which, being heated, act in the ſame manner that the aurum fulminans does when melted. It has been alſo a received opinion that theſe bubbles are occaſioned by ſome ſubtile elaſtic fluid tranſmitted from the fire thro' the bottom of the veſſel. However, I conceive that a fluid ſo ſubtile as to paſs thro' the bottom of the veſſel, would paſs alſo thro' the water ſo eaſily as not to diſturb it; and therefore I have for ſome time ſuſpected, that theſe bubbles are formed only by an elaſtic ſteam in the manner I ſhall now deſcribe. The particles on the ſurface of the water, long before it boils, will, by means of the repelling force which the heat introduces among them, riſe in ſteam, and will inſinuate themſelves into the air, which yields eaſily to them; but thoſe particles that are preſſed againſt the bottom, by the weight of the atmoſphere, and of the incumbent water, will require a greater degree of heat to render them ſo elaſtic that they ſhall be able to overcome this preſſure, and expand themſelves into a greater ſpace. Now ſince heat expands water, and makes its particles repel each other, according to its different degrees, we muſt ſuppoſe that theſe particles, from their being in contact with the bottom of the veſſel, will at length acquire ſuch a degree of heat as will give them a repelling force ſufficient to overcome the preſſure they ſuſtain, and to expand them ſuddenly into thoſe large bubbles that aſcend through the water when it boils violently.

"I have lately made ſome obſervations and experiments which ſeem to confirm this opinion. Theſe bubbles which aſcend from the bottom, I obſerved, always grow leſs in their progreſs upwards; and thoſe ſmall bubbles, that adhere to the bottom for ſome time before they aſcend, often diſappear entirely before they reach the ſurface, which ſhews that when the matter they contain, or any part of it, loſes the heat it had at firſt, it is again turned into water.

"When water that has juſt boiled, or is even conſiderably leſs hot than boiling water, is poured into a glaſs, and ſet under the receiver of an air-pump, and the air is almoſt drawn out, the water will boil more violently than it does on the fire, the bubbles breaking out from all parts of it. In this caſe, no ſubtile fluid can be ſuppoſed to riſe through the bottom of the veſſel, but the heat which the water retains will then give its particles an elaſtic force ſufficient to overcome the preſſure of what little air remains in the receiver, and will expand them into bubbles. And that theſe bubbles are compoſed of ſteam appears plainly from this experiment, for as ſoon as they begin to aſcend, the receiver is filled with ſteam, which being condenſed by the cold runs plentifully down its ſides in water. From hence we may ſee the reaſon why water in vacuo boils with a very ſmall degree of heat.

"After a veſſel of water had boiled till all the air-bubbles were driven out of it, I turned upon its mouth a large glaſs that lay under the water; the bubbles, that aſcended under the glaſs, remained in the upper part of it, and forced out the water it before contained, and then the elaſtic matter in the glaſs overturned it, and aſcended to the top in one large bubble, upon which the ſteam on the ſurface was much encreaſed. Now this ſhews that the matter contained in theſe bubbles, which at firſt is quite tranſparent, being a very rare and homogeneous fluid, appears afterwards like ſteam when it is mixed with the air. But I thought I ſhould make a concluſive experiment, if I could obſerve the effects of a very hot ſteam conveyed under boiling water. Therefore when an æolipile had boiled till all the air was driven out of the water it contained, without taking it off the fire, I immerſed its pipe into a veſſel of water which had juſt been boiled, and immediately the ſteam, that iſſued from the pipe, roſe up in very large bubbles thro' the water, and made it appear to boil violently. I then held a large glaſs of cold water, ſo that the pipe of the boiling æolipile was immerſed in it; at firſt none of theſe bubbles appeared, for the ſteam, being then condenſed by the cold water, was mixed through it, making a very loud and uncommon noiſe: but as ſoon as the water in the glaſs grew very hot, this noiſe ceaſed, and the ſteam, being no longer condenſed, roſe in large bubbles, as before, and made the water appear to boil with great violence.

"Theſe obſervations and experiments ſeem to diſcover fully to us the nature of thoſe bubbles that aſcend through boiling water; and lead me to make ſome further remarks on the degrees of heat that different liquors acquire in boiling.

"The parts of a fluid neareſt the bottom of a veſſel grow hot firſt, and being then expanded and made lighter, they aſcend and change place with the colder and heavier parts, which occaſions that inteſtine motion we perceive in liquors while they are growing hot. And thus the heat of the whole will continue to increaſe, until thoſe particles, that are in contact with the bottom of the veſſel, acquire ſuch a degree of heat as will give them a repelling force ſufficient to overcome the weight of the atmoſphere, the weight of the incumbent fluid, and the tenacity of its particles; and then they will be ſuddenly expanded into bubbles of ſteam, and aſcend quickly to the top, without communicating this heat to the ſurrounding fluid. For as theſe bubbles have a degree of heat but little ſuperior to that of the fluid, and juſt ſufficient to keep them expanded, if they were to loſe any of it, by communicating it to the fluid in their aſcent, they would all diſappear before they got to the ſurface, as the very ſmall ones do which aſcend but ſlowly; or if the whole fluid was to grow at once as hot as the bubbles, it would, like them, be all turned into an elaſtic ſteam. And therefore the fluid itſelf cannot grow hotter than it was when theſe bubbles began to aſcend; but muſt all boil away in the ſame degree of heat; provided it be ſuch a fluid as will not grow denſer, or more viſcid and tenacious by boiling: of this kind are mercury, water, ſpirit of wine, and ſeveral others, for theſe fluids are found to boil reſpectively with 600, 212, and 175 degrees of heat, and afterwards they do not grow hotter. The reaſon of which is plain, for whilſt the preſſure upon a fluid, and its denſity and tenacity continue the ſame; the ſame degree of heat will always be ſufficient to ſeparate its particles, and expand them into ſteam; which is the greateſt effect that fire can produce on any fluid without actually inflaming it. Hence it is obvious, that an additional preſſure on boiling liquors, or an encreaſe of their denſity or tenacity, will, by keeping their particles more ſtrongly together, enable them to bear a greater degree of heat before they are expanded into ſteam and begin to boil. It is very obſervable that all oily liquors, which refract the rays of light more ſtrongly than others do, acquire alſo a much greater heat in boiling. Thus oil of turpentine and other thin eſſential oils, that are procured by diſtillation, boil with about 560 degrees of heat, which however, as the boiling continues, is always encreaſing; the more volatile parts flying away, and leaving the reſidue thicker, more viſcid, and ſuſceptible of greater heat.

"Common vegetable and animal oils begin to boil with 600 degrees of heat, which is the ſame with that of boiling mercury, and therefore the greateſt heat that can be meaſured by a mercurial thermometer. But it has been found, by the expanſion of an iron rod, that oils grow continually hotter by boiling, and at length their heat encreaſes ſo much that they burſt into flame.

"There is indeed one obſervation, which, if true, would contradict what I have ſaid as to the heat of boiling liquors being in ſome meaſure owing to their viſcidity; for it is commonly ſaid that tar, which is a viſcid liquor, boils with ſo ſmall a degree of heat, that the workmen ſkim the droſs off it with their hands. But this I found to be only the appearance of boiling; for having placed a veſſel of tar on the fire, as ſoon as the thermometer ſhewed it to be a little hotter than the human blood, a great quantity of air roſe out of it in froth and bubbles, carrying up ſome droſs with it, and then I could eaſily bear to hold my finger in it; but ſoon after, when the tar began really to boil, the thermometer roſe as high as it does in boiling water, and was

ſtill riſing. For tar, when one half of it is boiled away, becomes pitch; and it is well known that boiling pitch is hotter than boiling water; ſo that this experiment correſponds exactly with the theory I have laid down in regard to the heat of boiling liquors.

"Hitherto we have conſidered only the effects of ſuch degrees of heat as are great enough to expand liquors into large bubbles and make them boil, or to raiſe a viſible ſteam from their ſurface. But I find it neceſſary, for a reaſon I ſhall mention preſently, to conſider alſo the effects of the leſſer degrees of heat, down to that which is juſt ſufficient to keep liquors in a ſtate of fluidity.

"It is generally allowed that heat keeps bodies fluid, by cauſing their particles in ſome meaſure to repel each other, and thereby preventing them from coming into ſuch cloſe contact as would render them hard. Now I ſhall ſhew from experiments that all degrees of heat above what is neceſſary to keep liquors fluid, will raiſe from their ſurface, provided they are not viſcid, ſome kind of ſteam, which, for diſtinction's ſake, I ſhall call an effluvium. Under a large glaſs ſet a cup of water, not hot enough to emit any viſible ſteam, and let the glaſs be expoſed to the cold air, a dew will ſoon appear on its inſide. Here an effluvium is raiſed from the water, but it riſes too ſlowly and in too ſmall a quantity to become viſible till it is condenſed on the glaſs. As ſteam riſes from hot liquors more abundantly when the preſſure of the atmoſphere is taken away, it may be ſuppoſed that this effluvium will alſo riſe more copiouſly from colder liquors in the ſame caſe, as we ſhall ſee it really does by what follows. From a great number of experiments made with ſpirits of wine, of different degrees of ſtrength, I found that, at a medium, the quantities loſt in the ſame time in a cloſe receiver full of air, in one only half full of air, in air rarefied two and forty times, and in the open air, were nearly in the proportion of 1, 1 4, 6, and 48. The ſame kind of ſpirit was uſed in each experiment, the time was 24 hours, and the ſpirits were contained in equal cups, ſo that their quantities and ſurfaces were as nearly equal as might be. That all the ſpirit uſed in each experiment might be in the ſame circumſtances, before I put it into the cups I drew from it all the air I could by the air-pump, which could not rarefy the air in the receiver more than two and forty times: it was neceſſary to do this, becauſe the ſpirit loſt five or ſix grains in a few minutes while the air was drawing from it by the firſt exhauſtion of the receiver, and a quantity leſs and leſs during the ſecond and third exhauſtions. A cup of water when in a warm room loſt one grain on the firſt exhauſtion, and when it had afterwards ſtood in the exhauſted receiver for 24 hours it loſt two grains and a half, while the ſame quantity of water loſt 35 grains in the open air; but ice that was thawing, or water with ice in it, did not loſe any thing in the exhauſted receiver, or in a cloſe receiver full of air. Theſe experiments were made in a large room without a fire, and the fluids were of the ſame temperature, whoſe loſſes I compared together.

"The ſpirit of wine, which is ſo eaſily rarefied by heat, and which, as it never freezes, has always more heat than is ſufficient to keep it fluid, loſt in every experiment conſiderably more than water did in the ſame circumſtances; and as water did not loſe any of its weight, when it had not more heat than was neceſſary to keep it fluid, I think the riſing of an effluvium from theſe liquors may juſtly be aſcribed to the repelling force given to their particles by certain degrees of heat. The air in the receiver did not contribute to this effect, but on the contrary prevented it, in a great meaſure, by its preſſure, for the more air was drawn from the receiver, the greater quantity of this effluvium aroſe. I obſerved, that when the air was rarefied two and forty times, the effluvium that roſe from the ſpirit, which was ſometimes near forty grains in twenty-four hours, not being ſupported by a ſufficient quantity of air, and loſing its firſt elaſticity by being very much expanded, fell by its weight to the bottom, and covered it and the lower parts of the receiver with moiſture. But none, or very little, of this moiſture appeared when only one half of the air was drawn out of the receiver; for the effluvium which then aſcended, amounting generally to eight or nine grains, was ſupported by the remaining air; but when I rarefied this air ſuddenly, as in an experiment before mentioned, the effluvium was immediately gathered into a vaſt number of viſible drops, and fell to the bottom. This plainly ſhews that the effluvia which are raiſed from liquors, by theſe very ſmall degrees of heat, cannot continue ſuſpended, unleſs they are ſupported by a ſufficient quantity of air.

"I thought it neceſſary to make theſe experiments and obſervations, in order to obviate an objection which might be made to the principle I have endeavoured to eſtabliſh. For as it is found that fluids loſe of their weight both in an exhauſted receiver, and in the open air, it might be ſaid that this loſs proceeded from the ſame cauſe in both caſes, and therefore that common evaporation did not depend on the diſſolving power of the air. But from theſe experiments, I think, we might give a ſufficient anſwer to ſuch an objection. For it appears firſt; that ice, or water, that has no more heat than is neceſſary to keep it fluid, loſe nothing of their weight in an exhauſted receiver, though they loſe very conſiderably in the open air. Secondly, the quantity which the ſpirit of wine loſt by evaporation in the open air was eight times greater than what it loſt in the ſame time by an effluvium, when the air in the receiver was rarefied two and forty times; therefore the cauſe of evaporation muſt be a much more powerful one than that which raiſed the effluvium. And further, the quantity loſt by evaporation was forty-eight times greater than what was loſt, in the ſame time, by an effluvium, when the receiver was full of air; therefore, ſuppoſing the ſame effluvium to riſe from it in the open air, we muſt allow that of the whole quantity which the ſpirit of wine loſt in the open air, one part only in forty-eight could be owing to that effluvium which is occaſioned merely by its heat, conſequently forty-ſeven parts muſt have been carried off by ſome very powerful action of the air; which muſt alſo be the ſole cauſe of the evaporation of ice or very cold water, which are found not to emit any effluvia in an exhauſted receiver. And this action of the air I have ſhewn to be its diſſolving power.

"Before we conclude, it may not be amiſs to take a general view of the important purpoſes which air is contrived to anſwer, and of the means by which it is adapted to theſe ſeveral purpoſes. By its ſubtilty and elaſticity it is capable of being eaſily taken into the lungs of animals; and by its attracting and diſſolving power it carries on that perſpiration, both internal and external, which we find is neceſſary to the preſervation of life. By the ſame power it takes away the ſuperfluous moiſture from trees and plants, and thereby promotes vegetation. By the ſame power, it raiſes and ſuſtains aqueous vapours, and its temperature and denſity being eaſily changed, it returns them again in rain and dew, and thus keeps up a continual circulation of moiſture. By the ſame power it contributes to the ſupport of fire, by carrying off from burning-bodies all ſuch fumes and vapours as would otherwiſe extinguiſh them.

"By its weight and preſſure on the ſurface of fluids it keeps their particles together, and enables them to bear, without being diſperſed in ſteam, ſuch degrees of heat as are neceſſary for all thoſe uſes to which boiling liquors are applied. By the ſame preſſure it raiſes water in pumps and other hydraulic engines.

"And laſtly; we may add to theſe, all the various purpoſes to which the winds are ſubſervient; and which are too many to be enumerated, and too well known to require being particularly mentioned."

VAPORARIUM, a vapor-bath, in chemiſtry, implies a bath, or heat, wherein a body is placed ſo as to receive the fumes of boiling water.

VAPOUR. See the article VAPOR.

VAPOURS, in medicine, is the ſame with what is otherwiſe called the hypochondriacal diſeaſe. See the article HYPOCHONDRIAC *Paſſion*.

VARI, in medicine, are little hard and ruddy tumours, which frequently infeſt the faces of young perſons of a hot temperament of body. The method of curing them is by giving cooling cathartics, and uſing a

diluting

diluting diet. The cure however becomes more difficult in thoſe which are of a lively red; for when the puſtules are taken away the redneſs remains.

VARIABLE *Quantities*, in algebra and geometry, imply ſuch quantities as are continually increaſing or diminiſhing; in oppoſition to thoſe which are conſtant, and remain always the ſame.

Thus the ſemi-ordinates, and abſciſſes of an ellipſis, &c. are variable quantities; becauſe whenever the one increaſe, the other increaſes alſo. See the article FLUXIONS.

VARIABLE *Winds*. See the article WIND.

VARIANCE, in law, implies an alteration of ſomething formerly laid in a plea: but where a plea is good in ſubſtance, it is held that a ſmall variance will not injure it.

VARIANCE, alſo implies an alteration or change of condition in a perſon or thing; after ſome former concern, or tranſaction therewith.

VARIATION, in geography and navigation, is the deviation of the magnetical needle, from the true north-point of the horizon; or it is an arch of the horizon intercepted between the meridian of the place of obſervation, and the magnetic meridian. See the articles COMPASS and MAGNET.

The variation of the needle has within a century paſt undergone a remarkable alteration; for at London it was obſerved by Mr. Burrows, in the year 1580, to be 11° 15′ eaſt; that is, if N. S. (plate CXXXIV. *fig.* 3.) repreſent the north and ſouth points of the horizon, and E. W. the eaſt and weſt points, the needle then had the ſituation A B, ſo that the arch B N = 11° 15′. After that, in the year 1622, it was obſerved by Mr. Gunter to be but 6° eaſt. In the year 1634, Mr. Gellibrand obſerved it to be 4° 5′ eaſt. In 1657, it was obſerved by Mr. Bond to be nothing at all; that is, the needle placed itſelf in the ſituation S. N. and pointed directly to the north. After this, in the year 1672, Dr. Halley obſerved it to be 2° 30′ weſtward; and again, in the year 1692, he found it 6° weſt. Since then, in the year 1722, Mr. Graham, by moſt accurate experiments, found it to be 14° 13′; and at preſent it is between 15° and 16°; and in ſome places it is found 18° weſtward.

The variation of the declination and inclination of the needle is variable, and ſubject to no regular computation. What the quantity of both ſorts of variation is in the ſeveral parts of the world, is ſhewn in Dr. Halley's map of the world, improved from the obſervations of Mr. Pound.

If the ſun's true amplitude or azimuth, found by calculation, agree with the magnetic amplitude or azimuth, found by obſervation, it is evident there is no variation; but if they diſagree, and the true and obſerved amplitudes, at the riſing or ſetting of the ſun, be both of the ſame name; that is, either both north, or both ſouth, their difference is the variation: whereas, if they be of different names, i. e. one north and the other ſouth, their ſum is the variation. Again, if the true and obſerved azimuths be both of the ſame name, i. e. both eaſt or both weſt, their difference is the variation; but if they be of different names, their ſum is the variation: and to know whether the variation be eaſterly or weſterly, obſerve the following general rule; let the obſerver's face be turned towards the ſun, then if the true amplitude or azimuth be to the right-hand, the variation is eaſterly; but if to the left, weſterly. To illuſtrate this, let N E S W. (*fig.* 4.) repreſent a compaſs; and ſuppoſe the ſun is really E *b* S at the time of obſervation, but the obſerver ſees him off the eaſt point of the compaſs, and ſo the true amplitude or azimuth of the ſun is to the right of the magnetic, or obſerved: here it is evident, that the E *b* S point of the compaſs ought to lie where the eaſt point is, and ſo the north where the N *b* W is; conſequently the north point of the compaſs is too far eaſt, i. e. the variation in this caſe is eaſterly. The ſame will hold when the amplitude or azimuth is taken on the weſt-ſide of the meridian.

Again, let the true amplitude or azimuth be to the left hand of the obſerved; thus ſuppoſe the ſun is really E *b* N at the time of obſervation, but the obſerver ſees him off the eaſt point of the compaſs, and ſo the true amplitude or azimuth to the left of the obſerved: here it is evident, that the E *b* N point of the compaſs ought to ſtand where the eaſt point is, and ſo the north where the N *b* E point is; conſequently, the north point of the compaſſes lies a point too far weſterly, ſo in this caſe the variation is weſt. The ſame will hold when the ſun is obſerved on the weſt ſide of the meridian.

Suppoſe the ſun's true amplitude at riſing is found to be E. 14° 20′ N. but by the compaſs it is found to be E. 26° 12′ N. Required the variation, and which way it is.

Since they are both the ſame way, therefore,

from the magnetic amplitude —— —	E. 26° 12′ N.
take the true amplitude —— —— —	E. 14° 20′ N.
and there remains the variation —— ——	11 52 E.

which is eaſterly, becauſe in this caſe the true amplitude is to the right of the obſerved.

VARIATION *of the Moon*, in aſtronomy, is the third inequality obſerved in that planet's motion. See the article MOON.

VARIATION *of the Variation*, is the change in the declination of the needle obſerved at different times in the ſame place.

VARIATION *of Quantities*, in algebra. See the article COMBINATION.

VARIATION *of Curvature*, in geometry, is uſed for that inequality or change which happens in the curvature of all curves, except the circle; and this variation or inequality conſtitutes the quality of the curvature of any line.

Sir Iſaac Newton makes the index of the inequality or variation of curvature to be the ratio of the fluxion of the radius of curvature to the fluxion of the curve; and Mr. Mac Laurin, to avoid the perplexity that different notions, connected with the ſame terms, occaſion to learners, has adopted the ſame definition; but he ſuggeſts, that this ratio gives rather the variation of the ray of curvature, and that it might have been proper to have meaſured the variation of curvature, rather by the ratio of the fluxion of curvature itſelf to the fluxion of the curve; ſo that the curvature being inverſely as the radius of the curvature, and conſequently its fluxion as the fluxion of the radius itſelf directly, and the ſquare of the radius inverſely, its variation would have been directly, as the meaſure of it, according to Sir Iſaac's definition, and inverſely as the ſquare of the radius of curvature.

VARIATION, in muſic, is underſtood of the different manners of playing or ſinging a tune or ſong, whether by ſubdividing the notes into ſeveral others of leſſer value, or by adding graces, &c. in ſuch manner, however, as that one may ſtill diſcern the ground of the tune through all the enrichments; which are called embroideries.

VARICIFORMES PARASTATÆ, in anatomy, a name which ſome authors give to two veſſels near the bladder, by reaſon of their many turnings, ſerving to work and prepare the ſeed the better. See DEFERENTIA VASA.

VARIEGATION, among botaniſts and floriſts, the ſtreaking and diverſifying the leaves of plants, and the petals of flowers, with ſeveral colours.

Thoſe leaves whoſe middles are variegated with yellow or white, in ſpots, are called bloached; as in ſeveral varieties of holly: but when the leaves are edged with either colour, they are called ſtriped plants.

All the different ſorts of variegation in plants were at firſt accidental, being no more than a diſtemper in the plant, which, being obſerved, has been cheriſhed by impoveriſhing the ſoil in which they grow, by which method their ſtripes are rendered more laſting and beautiful; but whatever ſome perſons have affirmed of ſtriping plants by art, there does not appear any foundation for ſuch aſſertion, unleſs in woody ſhrubs and trees, which may be variegated by putting in a bud or graft taken from a variegated plant, where although the buds ſhould not grow, yet if they keep freſh but a few days, they will often communicate their miaſma to the ſap of the tree into which they were budded; ſo that in a ſhort time after, it has appeared very viſible in the next adjoining

ing leaves, and has afterwards ſpread over the greateſt part of the tree; but in ſuch plants as are herbaceous, where this operation cannot be performed, there is no way yet aſcertained whereby this ſtriping can be effected by art.

That this ſtriping proceeds from the weakneſs of the plant, is evident, ſince it is always obſerved, that whenever plants alter thus in the colour of their leaves, they do not grow ſo large as before, nor are they ſo capable of enduring cold; ſo that many ſorts of plants, which are hardy enough to ſurvive the cold of our climate in the open air, when in their natural verdure, require to be ſheltered in the winter, after they are become variegated, and are ſeldom of ſo long continuance: which is a plain proof of its being a diſtemper in the plants, ſince, whenever they become vigorous, this ſtriping is rendered leſs viſible, or entirely diſappears, eſpecially if the plants are only bloached.

With ſome plants the venom of this morbid matter is ſuch, that it not only tinges the leaves, but alſo the bark and fruit; as in the orange, pear, &c. whoſe bark and fruit are ſtriped in the ſame manner as their leaves.

The different colours which appear in flowers proceed alſo from the ſame cauſe; for the various colours which we ſee in the ſame flowers, are occaſioned by the ſeparation of the nutritive juice of plants, or from the alteration in their parts, whereby the ſmaller corpuſcles, which are carried to the ſurface of the flower-leaves, are of different forms, and conſequently reflect different rays of light, whereby we obtain thoſe various appearances of colour.

Among all the kinds of variegated flowers, none are more beautiful than the auricula, carnation, and tulip.

VARIOLÆ, the ſmall-pox; See the article Pox.

VARIORUM, or *Cum Notis* VARIORUM, denotes an edition of a claſſic author, elucidated with the notes of various authors; and theſe editions are generally the moſt valued.

VARIX, in medicine, a dilation of a part of a vein ſo as to make it bulge out, and form a little, ſoft, knotty, but painleſs tumour.

Sometimes it is confined to one ſingle branch of a vein; ſometimes it extends to ſeveral; and ſometimes it runs crooked, and bent in various knots and circumvolutions.

It moſt frequently happens to the crural and hæmorrhoidal veins; ſometimes alſo to thoſe of the teſtes, and often to thoſe in the abdomen and breaſts of pregnant women, and ſuch as give ſuck. It is ſuppoſed to ariſe from the great abundance or thickneſs of the blood; or to the relaxation of the membranes of the veins; immoderate labour, ſprains, cramps, to the great preſſure or ſtricture by bandages. Stagnations of the blood from a plethora, &c. may alſo occaſion varices.

Melancholy perſons, and thoſe who feed on coarſe meats, are moſt ſubject to them: the generality of women with child have varices on their thighs and legs, occaſioned by the fœtus compreſſing the iliac veins; and by that means preventing the reflux of blood to the heart.

Varices happening ſpontaneouſly, and proving of a moderate ſize, are rarely dangerous; they are even allowed to be of ſervice in the caſe of hæmorrhoids. When immoderate they ſometimes occaſion a cachexy, dropſy, or conſumption.

The cure is to be attempted by evacuations, as phlebotomy, and cathartics: external applications, as diſcutient fomentations, cataplaſms, embrocations, bandages, &c. and where the caſe becomes dangerous, by inciſion.

VARNISH, or VERNISH, a thick, viſcid, ſhining liquor, uſed by painters, gilders, and various other artiſts, to give a gloſs and luſtre to their works; and at the ſame time to defend them from the weather, duſt, &c.

There are ſeveral kinds of varniſhes in uſe; as the drying varniſh made of oil of turpentine, common turpentine and gum ſandarach, melted together. White varniſh made of oil of turpentine, fine turpentine, and maſtic. Spirit varniſh, the menſtruum of which is ſpirit of wine, in which are diſſolved gum elemi, ſandarach, maſtic, white amber, &c.

1. To make the white varniſh: take gum ſandarach, of the cleareſt and whitiſh ſort, eight ounces; gum maſtic, of the cleareſt ſort, half an ounce; of ſarcocolla, the whiteſt, three quarters of an ounce; Venice turpentine, an ounce and a half; benzoin, the cleareſt, one quarter of an ounce; white roſin, one quarter of an ounce; gum animæ, three quarters of an ounce: let all theſe be diſſolved, and mixed in the following manner.

Put the ſarcocolla and roſin into a little more ſpirits than will cover them to diſſolve; then add the benzoin, gum animæ, and Venice turpentine, into either a glaſs or glazed earthen veſſel, and pour on as much ſpirits as will cover them an inch; then put the gum maſtic into a glaſs or glazed veſſel, and pour ſtrong ſpirits upon it, covering it alſo about an inch thick, to diſſolve it rightly; then put your gum elemi into a diſtinct veſſel as before, and cover it with ſpirits to diſſolve.

For this purpoſe, you need only break the roſin a little, and powder the gum animæ, ſarcocolla, and benzoin.

Let all ſtand three or four days to diſſolve, ſhaking the glaſſes, &c. two or three times a day, and afterwards put them all together into a glazed veſſel, ſtirring them well, and ſtrain the liquor and gums gently, beginning with the gums, through a linen cloth.

Then put it into a bottle, and let it ſtand a week before you uſe it, and pour off as much of the clear only, as you think ſufficient for preſent uſe.

2. The white amber varniſh is thus made according to Mr. Boyle: take white roſin, four drams, melt it over the fire in a clean glazed pipkin; then put into it two ounces of the whiteſt amber you can get, finely powdered.

This is to be put in by a little and a little, gradually, keeping it ſtirring all the while with a ſmall ſtick, over a gentle fire, till it diſſolves, pouring in now and then a little oil of turpentine, as you find it growing ſtiff; and continue ſo to do till all your amber is melted.

But great care muſt be taken not to ſet the houſe on fire, for the very vapours of the oil of turpentine will take fire by heat only; but if it ſhould happen ſo to do, immediately put a flat board or wet blanket over the fiery pot, and by keeping the air from it, you will put it out, or ſuffocate it.

Therefore it will be beſt to melt the roſin in a glaſs of a cylindric figure, in a bed of hot ſand, after the glaſs has been well annealed, or warmed by degrees in the ſand, under which you muſt keep a gentle fire.

When the varniſh has been thus made, pour it into a coarſe linen bag, and preſs it between two hot boards of oak or flat plates of iron; after which it may be uſed with any colours in painting, and alſo for varniſhing them over when painted.

But for covering gold, you muſt uſe the following varniſh: mean time, it is to be obſerved, that when you have varniſhed with white varniſh, you may put the things varniſhed into a declining oven, which will harden the varniſh.

3. A hard varniſh that will bear the muffle, may be thus made: take of colophony, an ounce; ſet it over the fire in a well-glazed earthen veſſel, till it is melted; then by little and little, ſtrew in two ounces of powder of amber, keeping it ſtirring all the while with a ſtick; and when you perceive it begin to harden or reſiſt the ſtick, then put in a little turpentine oil, which will thin and ſoften it immediately; then put in two ounces of gum copal, finely powdered, ſprinkling it in as you did the amber, now and then pouring in a little oil of turpentine; and when it is done, ſtrain it as before directed.

This is proper to varniſh over gold; and the things done with it muſt be ſet into a declining oven, three or four days ſucceſſively, and then it will reſiſt even the fire itſelf.

4. To make a varniſh for braſs, that will cauſe it to look like gold. Take two quarts of ſpirit of wine, and put it into a retort-glaſs; then add to it an ounce of gamboge, two ounces of lacca, and two ounces of maſtic; ſet this in a ſand-heat for ſix days, or elſe near a fire, or you may put the body of the bolt-head frequently into

warm water, and ſhake it two or three times a-day; then ſet it over a pan of warm ſaw-duſt. But before this varniſh is laid over the metal, let it be well cleaned.

This is a good varniſh to mix with any colours that incline to red, and the amber-varniſh for mixing with thoſe that are pale.

5. To make a varniſh for gold, or metals made in imitation of gold. Take colophony, and, having melted it, put in two ounces of amber finely powdered, and ſome ſpirit of turpentine, and, as the amber thickens, keep it well ſtirring; then put in an ounce of gum elemi, well pulverized, and more ſpirit of turpentine; conſtantly ſtirring the liquor till all is well mixed and incorporated: but take care, however, to uſe as little turpentine as you can, becauſe, the thicker the varniſh is made, the harder it will be. Let this be done over a ſand-heat, in an open glaſs; then ſtrain it, as is directed for the preceding varniſh. This varniſh is to be uſed alone, firſt warming the veſſels made of paper-paſte; and lay it on with a painting bruſh before the fire, but not too near, leſt the fire raiſe it into bliſters. After this has been done, harden it three ſeveral times in ovens; firſt with a ſlack heat, the next with a warmer, and the third with a very hot one; and the veſſels will look like poliſhed gold.

And as for ſuch veſſels, &c. as ſhall be made with ſaw-duſt and gums, the varniſh may be made of the ſame ingredients as above-mentioned, except the gum elemi; and this will dry in the ſun, or in a gentle warmth.

6. To make a varniſh for any thing covered with leaf ſilver. Firſt paint the thing over with ſize, and ground chalk or whiting; let them ſtand till they are thoroughly dry, and then do them over with very good gold-ſize, of a bright colour (for there is much difference in the colour of it; ſome being yellow, and others almoſt white; the firſt is moſt proper for gold, and the laſt for ſilver.) When this ſize is ſo dry as that it will juſt ſtick a little to the touch, lay on the leaf-ſilver, and cloſe it well to the ſize.

7. To make a varniſh for ſilver. Melt, in a well glazed pipkin, ſome fine turpentine, and put in three ounces of white amber, finely powdered (more or leſs, according to the quantity your work will require) put it in by little and little, keeping it continually ſtirring, adding by degrees ſome ſpirit of turpentine, till all the amber is diſſolved; and then add to it an ounce of ſarcocolla well beaten, and an ounce of gum elemi well levigated, adding now and then a little ſpirit of turpentine, till all is diſſolved: do this over a gentle fire, and keep it conſtantly ſtirring.

This varniſh will be as white and ſtrong as the former; and is to be uſed warm, and hardened by degrees in an oven, as varniſhed gold, whereby it will look like poliſhed ſilver.

Laying on of VARNISHES. 1. If you varniſh wood, let your wood be very ſmooth, cloſe-grained, free from greaſe, and rubbed with ruſhes.

2. Lay on your colours as ſmooth as poſſible; and, if the varniſh has any bliſters in it, take them off by a poliſh with ruſhes.

3. While you are varniſhing keep your work warm, but not too hot.

4. In laying on your varniſh begin in the middle, and ſtroke the bruſh to the outſide; then to another extreme part, and ſo on till all be covered; for if you begin at the edges, the bruſh will leave blots there, and make the work unequal.

5. In fine works, uſe the fineſt tripoli in poliſhing: do not poliſh it at one time only, but, after the firſt time, let it dry for two or three days, and poliſh it again for the laſt time.

6. In the firſt poliſhing, you muſt uſe a good deal of tripoli, but in the next, a very little will ſerve: when you have done, waſh off your tripoli with a ſponge and water; dry the varniſh with a dry linen rag; and clear the work, if a white ground, with oil and whiting; or, if black, with oil and lamp-black.

VARNISHING *and preſerving Pictures and Paintings.*—The method of preſerving paintings in oil is by coating them with ſome tranſparent and hard ſubſtance, as a varniſh, to ſecure the colours from the injuries of the air or moiſture; and to defend the ſurface from ſcratches or any damages the painting might receive from ſlight violences.

The ſubſtances, that have been, or may be uſed for this purpoſe, are gum arabic, glair or whites of eggs, iſinglaſs ſize, and varniſhes formed of gum reſins diſſolved in ſpirit of wine, or oil of turpentine; which laſt, where oil of turpentine is uſed, are called oil varniſhes.

Gum arabic has been uſed, diſſolved in water, as a varniſh for pictures and paintings, on account of its being both more eaſily laid on, and taken off, than the varniſhes formed of ſpirit of wine or oil of turpentine. It is more eaſily laid on, becauſe it may be made exactly of that degree of viſcidity with which it can be beſt worked with a bruſh or pencil; and becauſe it is totally free from that accident called chilling, which attends all varniſh made with ſpirit of wine. There is, however, along with theſe, another quality of ſo bad a kind, that its effects more than countervail theſe advantages in the uſe of gum arabic, as a varniſh for paintings; which is, that as it dries, it is extremely apt to crack; and give ſuch appearance of flaws and ſcratches, as obſcure and deform the painting to an intolerable degree; and, therefore, this gum is at preſent much rejected with reſpect to this application; and the ſubſtance we ſhall next conſider ſubſtituted in its place. The addition of ſugar or ſugar-candy will greatly prevent the cracking of gum arabic; but then it gives a viſcidity or ſtickineſs to the gum that makes the ſurface of the painting ſully, and is in a manner equally detrimental with the cracking of the gum.

Glair of eggs, beat to an unctuous conſiſtence, and ſpread with a proper bruſh over the paintings, anſwers much the ſame end as gum arabic: but has the like advantages with much leſs of the bad quality of cracking: for which reaſon it is generally preferred to that gum. It has, nevertheleſs, one great defect, which is its not laſting; for it requires to be renewed frequently, as either moiſture or great dryneſs of the air injure it. It is uſual to mix a little brandy or ſpirit of wine with the glair of the eggs, in order to make it work more freely with a bruſh; as alſo a lump of ſugar to give it more body and prevent its cracking; from which, after all, it will not be intirely free, after it has ſome time laid on, if the picture be put into a very dry place.

Iſinglaſs ſize may be uſed for a varniſh in the ſame manner as the ſolution of gum arabic or the glair of eggs; and if a little honey or ſugar, about a fourth or fifth of the weight of the iſinglaſs, be added to it, it will cover more effectually than either of them, and yet be free from cracking. This is not, however, ſo laſting a varniſh as the gum reſins, eſpecially if the painting or picture be brought into a damp ſituation; and indeed in all caſes it is apt to turn very yellow with time: but where there is a proſpect of having occaſion to take off the varniſh for altering the painting, this will be found a very good one; as it may be intirely removed by means of a ſponge and hot water.

There have been many compoſitions invented for ſpirit and oil varniſhes for paintings: but the multiplying a number of ingredients in ſuch compoſitions is by no means attended with advantages that are equivalent to the trouble. We will, however, give one of the applauded recipes of each kind; and then ſubjoin to it another more ſimple, which we believe will better anſwer the purpoſe.

"Take of gum ſandarac half a pound, of Venice turpentine one ounce and half, of the gums animi, and copal, each three quarters of an ounce, of maſtic half an ounce, of benjamin, gum elemi, and white reſin, each two drams, of rectified ſpirit of wine one pound. Powder the benjamin and gum animi; and put to them and the Venice turpentine, contained in a proper ſized phial, eight ounces of the ſpirit of wine; to the copal and reſin powdered, put, in like manner, in a phial, ſix ounces; and to the powdered gum elemi two ounces. Let them ſtand, ſhaking the phials frequently, till the gums, &c. be diſſolved. Then ſtrain all the ſolutions through a piece of fine linen into one bottle; and after

the mixture has ſtood ſome days, decant off as much as will ſeparate clear; and keep it in a bottle well ſtopt for uſe."

Some omit the copal, which is in fact ſo much the ſame with the animi, that there is no certain mark of diſtinction known; and put in its place the ſame quantity of gum ſarcocol: but it is not of any conſequence, which is admitted; nor whether three parts in four of the ingredients be rejected: for the following will anſwer the end equally well.

"Take of the gums maſtic and ſandarac, powdered groſsly, each ſix ounces, of Venice turpentine half an ounce, diſſolve them in a quart of highly rectified ſpirit of wine, and ſtrain off the ſolution as the above. If this be wanted harder, an equal weight of the gums animi or copal may be added, and the quantity of ſpirit of wine doubled."

In the uſing this kind of varniſh great care muſt be taken that the picture receive no damage from it: for the diſſolving power of the ſpirit of wine will ſometimes reach the oil of the painting, and conſequently diſturb the colours.

The varniſh ſhould, therefore, be ſpread with as little and as gentle work of the pencil as poſſible; and care ſhould be taken, likewiſe, that the painting be thoroughly dry before the operation be attempted. There is alſo another nice circumſtance to be attended to in the uſe of this kind of varniſh, which is to avoid what is called the chilling of it; and will certainly happen, if the varniſh be not laid on in a very warm place, or the picture itſelf warmed to a moderate degree: and this will be ſtill more liable to happen, if the ſpirit of wine employed be not very highly rectified. If the varniſh appear to be chilled, (that is, when the parts of the gums do not attract each other; but precipitate from the phlegm, left by the ſpirit on its evaporating away, in the form of a powder, which gives a miſty turbid appearance to the ſurface, inſtead of a tranſparent ſhining one) another coat ſhould be laid over it, which will in general remedy the miſchief; and indeed leſs than two or three coats of this kind of varniſh is not ſufficient to preſerve the painting, and bring out the due effect of the colours; if they are in that ſtate called ſunk in, occaſioned by the attraction of the cloth on the oils mixed with them.

The following is a recipe for an oil of turpentine varniſh of the more compound kind.

"Take of the gums maſtic and ſandarac, each four ounces, of white reſin two ounces, of the gums ſarcocol, animi, copal, and olibanum, each one ounce. Powder them groſsly; and put them into a phial with two pounds of oil of turpentine; ſtop the phial, but not too faſt, leſt it burſt: and place it in any heat; the greater the better, under that which will make it boil. Let it ſtand there, till the gums be diſſolved, or at leaſt ſo much of them as will be diſſolved, then ſtrain off the ſolution for uſe."

The ingredients, except the maſtic and ſandarac, may be omitted at diſcretion: and with reſpect to the gums animi and copal, under which names, a variety of gums brought from the Eaſt and Weſt-Indies, as well as Africa, paſs, there are a very few parcels which will be found to diſſolve in oil of turpentine. Indeed we have never found any that would be ſo diſſolved: but recipes like this have been given upon very good authority. The following, therefore, will be found a much cheaper, leſs troubleſome, and equally good varniſh with that made by this complex mixture.

"Take of gum ſandarac two ounces, of maſtic and olibanum each an ounce and half; or three ounces of maſtic, and Venice turpentine half an ounce: powder them; and diſſolve them in half a pound of oil of turpentine: proceeding as in the above."

When this kind of varniſh is uſed, it is particularly neceſſary that the painting ſhould be thoroughly dry; and the pencil uſed as gently and ſparingly in the laying it on as poſſible: for the oil of turpentine is extremely ready to diſſolve the oil of the painting, if it be the leaſt within its power: on which account the varniſhes of this ſort are much leſs uſed now than formerly. This varniſh, however, will ſpread much more eaſily than that with ſpirit of wine; and is not ſubject to chill, even though it be laid on without the aid of any warmth: but it is proper, nevertheleſs, to be very careful, that there be no damp or moiſture on the ſurface of the painting; which would prevent the varniſh from taking hold; and wholly fruſtrate the intention of it.

Varniſhes have been uſed, likewiſe, formed of the gums ſandarac, olibanum, and arabic, with white reſin and turpentine, diſſolved in linſeed oil; but they are greatly out of uſe now, as ſuch varniſhes are ſlow in drying; and the linſeed oil will turn yellow; beſides the diſadvantage ariſing from the impracticability of ever taking them off the painting again, whatever occaſion there may be for it. But a very ſecure and good varniſh may, nevertheleſs, be made, by diſſolving two ounces of ſandarac and olibanum, with half an ounce of Venice turpentine, in half a pound of old nut or poppy oil which is white; and if too fat for other uſe, the better.

All theſe varniſhes muſt be carefully laid on with a pencil or bruſh, according to the circumſtances before intimated to be proper for each kind: but with reſpect to thoſe made of ſpirit of wine or oil of turpentine, particular care muſt be taken not to paſs the pencil or bruſh more than once over the ſame place; for, otherwiſe, it will produce ſtreaks and inequalities which ſpoil the effect.

Paintings in miniature are preſerved by means of plates of glaſs, or the talc called iſinglaſs, placed in the frame before them. There is no particular method to be obſerved in doing this: but to make the frame ſo compact, that the air may have no acceſs; which, otherwiſe, will ſometimes prey upon the colours.

Paintings in freſco, where they are of conſequence enough to merit ſuch care, may be rendered more durable, and preſerved from foulneſs, by varniſhing them with hot ſize boiled to a ſtrong conſiſtence, in which a fifteenth or twentieth part of honey has been diſſolved.

Paintings in varniſh require no means of preſervation, but from violence; the varniſh itſelf being a very ſufficient defence of the colours againſt the air, moiſture, or all other ſubſtances that might affect them.

VARNISH, alſo ſignifies a ſort of ſhining coat, wherewith potter's ware, Delft ware, China ware, &c. are covered, which gives them a ſmoothneſs and luſtre. Melted lead is generally uſed for the firſt, and ſmalt for the ſecond. See GLAZING.

VARNISH, among medalliſts, ſignifies the colours antique medals have acquired in the earth.

The beauty which nature alone is able to give to medals, and art has never yet attained to counterfeit, enhances the value of them; that is, the colour which certain ſoils, in which they have a long time lain, tinges the metals withal: ſome of which are blue, almoſt as beautiful as the turquoiſe; others with an inimitable vermilion colour; others with a certain ſhining poliſhed brown, vaſtly finer than Braſil figures.

The moſt uſual varniſh is a beautiful green, which hangs to the fineſt ſtrokes without effacing them, more accurately than the fineſt enamel does on metals.

No metal but braſs is ſuſceptible of this; for the green ruſt that gathers on ſilver always ſpoils it, and it muſt be got off with vinegar, or lemon-juice.

Falſifiers of medals have a falſe or modern varniſh, which they uſe on their counterfeits, to give them the appearance, or air, of being antique. But this may be diſcovered by its ſoftneſs, it being ſofter than the natural varniſh, which is as hard as the metal itſelf.

Some depoſit their ſpurious metals in the earth for a conſiderable time, by which means they contract a ſort of varniſh, which may impoſe upon the leſs knowing; others uſe ſal armoniac, and others burnt paper.

VAS, a veſſel either for mechanical, chemical, culinary, or any other uſes. In anatomy, all the parts which convey a fluid are called veſſels, as the veins, arteries, and lymphatics.

VASA CONCORDIÆ, among hydraulic authors, are two veſſels, ſo conſtructed as that one of them, though full of wine, will not run a drop; unleſs the other, being

ing full of water, do run alſo. Their ſtructure and apparatus may be ſeen in Wolfius Element. Matheſ. t. I. Hydraul.

VASCULAR, VASCULARIS, in anatomy, is applied to any thing conſiſting of divers veſſels, veins, arteries, &c. We ſay, the vaſcular and valvular texture of the lungs. All the fleſh in an animal body, is found to be vaſcular, none of it parenchymous, as the ancients imagined.

VASCULAR, VASCULARIUS, in antiquity, was the denomination of a kind of artificers, among the ancient Romans; who made ſilver and gold veſſels without relievo's or figures imboſſed thereon.

Hence, according to Salmaſius, it is, that Cicero, in his ſixth oration againſt Verres, diſtinguiſhed *vaſcularius* from *cælator*, engraver.

In the art called by the Greeks, εμπαιστικη, which was the art of ſuperadding ornaments of precious ſtones, or rich metals, to vaſes of other metals; the vaſcularii and cælatores were different; the firſt being the goldſmiths who made the vaſe, the ſecond the ſculptors who added the ornaments. But in the art called τορευτικη, or the art of cutting bas reliefs, or ſtamping figures on metal; the vaſcularii were alſo cælatores, or engravers: that is, they who made the vaſe, made alſo the relievos or figures, wherewith it was enriched.

VASCULIFEROUS PLANTS, ſuch whoſe ſeeds are contained in veſſels, which are ſometimes divided into cells.

VASE, a term frequently uſed for ancient veſſels dug from under-ground, or otherwiſe found, and preſerved in the cabinets of the curious.

In architecture, the appellation vaſe is alſo given to thoſe ornaments placed on corniches, ſochles, or pedeſtals, repreſenting the veſſels of the ancients, particularly thoſe uſed in ſacrifice; as incenſe-pots, flower-pots, &c. They ſerve to crown or finiſh façades, or frontiſpieces; and hence called acroteria.

The term vaſe, however, is more particularly uſed in architecture, to ſignify the body of the Corinthian and Compoſite capital; otherwiſe called the tambour or drum, and ſometimes the campana or bell. See CORINTHIAN and COMPOSITE.

Vaſe is ſometimes alſo uſed, among floriſts, for what is more uſually called the calyx, or cup.

VASSAL, in old law-books, a perſon who vowed fidelity and homage to a lord, on account of ſome land, &c. which he held of him, in fee.

VASTUS, in anatomy, the name of two of the extenſor muſcles of the legs; the one, called vaſtus internus, ariſes from the whole internal ſide of the femur; and the other, called vaſtus externus, takes its riſe from the whole external ſide of the femur; and both together, with the cruralis and rectus, form a very robuſt and ſtrong tendon juſt above the knee, to which the patella adheres behind, and which is inſerted below the knee at a tubercle of the tibia.

VAT, or FAT, a veſſel for holding wine, ale, beer, cyder, &c. in the time of their preparation.

VATICAN, a magnificent palace of the pope of Rome, which is ſaid to conſiſt of ſeveral thouſand rooms: but the parts of it moſt admired are the grand ſtair-caſe, the pope's apartment, and eſpecially the library, which is one of the richeſt in the world, both in printed books and manuſcripts.

VAULT, *Fornix*, in architecture, an arched roof, ſo contrived that the ſtones which form it ſuſtain each other.

Vaults are, on many occaſions, to be preferred to ſoffits or flat ceilings, as they give a greater height and elevation, and are beſides more firm and durable.

Salmaſius obſerves, that the antients had only three kinds of vaults. The firſt was the fornix, made cradle-wiſe; the ſecond a teſtudo, i. e. tortoiſe-wiſe, which the French call cul de four, or oven-wiſe; and the third concha, or trumpet-wiſe.

But the moderns have ſubdivided theſe three ſorts into many more, to which they have given different names, according to their figures and uſes; ſome of them are circular, and others elliptical.

Again, the ſweeps of ſome are larger, others leſs, portions of a ſphere. All ſuch as are above hemiſpheres, are called high, or ſurmounted, vaults; and all that are leſs than hemiſpheres, are called low, or ſurbaſed, vaults, or teſtudines.

In ſome vaults the height is greater than the diameter; in others it is leſs: others, again, are quite flat, and only made with haunſes; others like ovens, or in the form of a cul de four, &c. and others growing wider as they lengthen, like a trumpet.

There are alſo Gothic vaults, with ogives, &c. See OGIVE, &c.

Of vaults ſome again are ſingle, others double, croſs, diagonal, horizontal, aſcending, deſcending, angular, oblique, pendent, &c.

Maſter VAULTS are thoſe that cover the principal parts of buildings, in contradiſtinction to the upper or ſubordinate vaults, which only cover ſome little part, as a paſſage or gate, &c.

Double VAULT is one that is built over another, to make the outer decoration range with the inner; or, to make the beauty and decoration of the inſide conſiſtent with that of the outſide, leaves a ſpace between the concavity of the one and the convexity of the other. Inſtances of which we have in the dome of St. Peter's at Rome, St. Paul's at London, and in that of the Invalids at Paris.

VAULTS *with Compartments*, are ſuch whoſe ſweep, or inner face, is enriched with pannels of ſculpture, ſeparated by platbands. Theſe compartments, which are of different figures, according to the vaults, and uſually gilt on a white ground, are made with ſtone or brick-walls, as in the church of St. Peter at Rome, or with plaiſter on timber vaults.

Theory of VAULTS.—A ſemi-circular arch or vault, ſtanding on two piedroits, or impoſts, and all the ſtones that compoſe them, being cut, and placed in ſuch manner, as that their joints or beds, being prolonged, do all meet in the center of the vault; it is evident, that all the ſtones muſt be in the form of wedges, i. e. muſt be wider and bigger at top, by virtue of which they ſuſtain each other, and mutually oppoſe the effort of their weight, which determines them to fall.

The ſtone in the middle of the vaults, which ſtands perpendicular to the horizon, and is called the key of the vault, is ſuſtained on each ſide by two contiguous ſtones, juſt as by two inclined planes; and, conſequently, the effort it makes to fall is not equal to its weight.

But ſtill that effort is the greater, as the inclined planes are leſs inclined; ſo that if they were infinitely little inclined, i. e. if they were perpendicular to the horizon, as well as the key, it will tend to fall with its whole weight, and would actually fall, but for the mortar.

The ſecond ſtone, which is on the right or left of the key-ſtone, is ſuſtained by a third, which, by virtue of the figure of the vault, is neceſſarily more inclined to the ſecond, than the ſecond is to the firſt; and conſequently the ſecond, in the effort it makes to fall, employs a leſs part of its weight than the firſt. For the ſame reaſon, all the ſtones from the key-ſtone employ ſtill a leſs and leſs part of their weight to the laſt; which reſting on a horizontal plane, employs no part of its weight; or, which is the ſame thing, makes no effort at all, as being intirely ſupported by the impoſt.

Now, in vaults, a great point to be aimed at is, that all the vouſſoirs or ſtones make an equal effort towards falling. To effect this, it is viſible, that as ſuch (reckoning from the key to the impoſt) employ ſtill a leſs and leſs part of its whole weight; the firſt, for inſtance, only employing one half, the ſecond one third, the third one fourth, &c. there is no other way of making thoſe different parts equal, but by a proportionable augmentation of the whole, i. e. the ſecond ſtone muſt be heavier than the firſt, the third than the ſecond, &c. to the laſt; which ſhould be infinitely heavier.

M. de la Hire demonſtrates what that proportion is, in which the weights of the ſtones of a ſemi-circular arch muſt be increaſed to be in æquilibrio, or to tend with equal forces to fall, which is the firmeſt diſpoſition a vault can have.

The architects before him had no certain rule to conduct themſelves by, but did all at random. Reckoning the

the degrees of the quadrant of a circle, from the key-ſtone to the impoſt, the extremity of each ſtone will take up ſo much the greater arch, as it is farther from the key.

M. de la Hire's rule is, to augment the weight of each ſtone above that of the key-ſtone, as much as the tangent of the arch of half the key. Now the tangent of the laſt ſtone of neceſſity becomes infinite, and of conſequence its weight ſhould be ſo too; but, as infinity has no place in practice, the rule amounts to this, that the laſt ſtones be loaded as much as poſſible, that they may the better reſiſt the effort which the vault makes to ſeparate them; which is called the ſhoot or drift of the vault.

Mr. Parent has ſince determined the curve, or figure, which the extrados or outſide of a vault, whoſe intrados, or inſide, is ſpherical, muſt have, that all the ſtones may be in æquilibrio.

Key of a VAULT is a ſtone or brick in the middle of the vault, in form of a truncated cone, ſerving to bind or faſten all the reſt.

Reins, or fillings up of a VAULT, are the ſides which ſuſtain it.

Pendentive of a VAULT, is the part ſuſpended between the arches or ogives.

Impoſt of a VAULT is the ſtone whereon the firſt vouſſoir, or arch-ſtone of the vault, is laid.

UBIQUITARIANS, in church hiſtory, a ſect of heretics, ſo called, becauſe they maintained, that the body of Jeſus Chriſt is *ubique*, every where, or in every place.

Brentius, one of the earlieſt reformers, is ſaid to have firſt broached this error in Germany, about the year 1560. Melanchton immediately declared againſt it, as introducing a kind of confuſion in the two natures of Jeſus Chriſt. On the other hand, it was eſpouſed by Flacius Illyricus, Oſiander, and others. The univerſities of Leipſic and Wirtemberg in vain oppoſed this hereſy, which gained ground daily. Six of their leaders, namely, Smidelin, Selneccer, Muſculus, Chemnitius, Chytræus, and Cornerus, having a meeting, in 1577, in the monaſtery of Berg, compoſed a kind of creed, or formulary of faith, in which the ubiquity of Chriſt's body was the leading article. However, the Ubiquitarians were not quite agreed among themſelves; ſome holding, that Jeſus Chriſt, even during his mortal life, was every where; and others dating the ubiquity of his body from the time of his aſcenſion only.

UBIQUITY, omnipreſence, an attribute of the Deity, whereby he is always intimately preſent to all things; gives the eſſe to all things; knows, preſerves, and does all in all things. See GOD.

For, ſince God cannot be ſaid to exiſt in all places, as placed therein, becauſe then he would need ſomething to his exiſtence, viz. place; and would have extenſion, parts, &c. he muſt be conceived to be every where, or in all things, as a firſt, univerſal, efficient cauſe, in all his effects.

He is preſent therefore to all his creatures, as a pure act or an exerciſe of an active virtue, which knows, preſerves, governs, &c. every thing. Nor are even finite minds preſent, otherwiſe than by operation.

UDDER, *Uber*, in comparative anatomy, that part in brutes wherein the milk is prepared, anſwering to the mammæ, or breaſts, in women.

VECTIS, the lever, one of the mechanical powers. See LEVER.

VECTOR, in aſtronomy, a line ſuppoſed to be drawn from any planet moving round a center, or the focus of an ellipſis, to that center or focus.

This, by ſome writers of the new aſtronomy, is called vector, or radius vector, becauſe it is that line by which the planet ſeems to be carried round its center, and with which it deſcribes areas proportional to the times.

VEDETTE, in the military art, a ſentinel on horſeback detached from the main body of the army, to diſcover and give notice of the enemy's deſigns.

VEER, a ſea-term, variouſly uſed. Thus veering out a rope, denotes the letting it go by hand, or letting it run out of itſelf. It is not uſed for letting out any running rope except the ſheet.

VEER is alſo uſed in reference to the wind; for, when it changes often, they ſay it veers about.

VEGETABLE, in phyſiology, a term applied to all plants, conſidered as capable of growth; that is, to all natural bodies which have parts organical formed for generation and accretion, but not ſenſation.

In vegetables, there is ſuppoſed to be a principle of life, commonly called the vegetative ſoul.

Boerhaave very ſcientifically defines a vegetable to be a body generated of the earth; to which it adheres, or is connected, by parts called roots, through which it receives the matter of its nouriſhment, and increaſe; and conſiſting of juices, and veſſels, ſenſibly diſtinct from each other. Or, a vegetable is an organical body, compoſed of veſſels and juices, every where diſtinguiſhable from each other; to which grow roots, or parts, whereby it adheres to ſome other body, from which it derives the matter of its life, and growth.

This definition furniſhes a juſt and adequate idea of a vegetable: for by its conſiſting of veſſels and juices, it is diſtinguiſhed from a foſſil; and by its adhering to another body, and deriving its nouriſhment therefrom, it is diſtinguiſhed from an animal.

A vegetable is defined an organical body, becauſe conſiſting of different parts, which jointly concur to the exerciſe of the ſame function.

Adhering by ſome of its parts to another body; for we know of no plant that is ſo abſolutely vague and fluctuating, but has ſtill a body it adheres to; though that body may be various, e. gr. earth, as in our common plants; ſtone, as in rock-plants; water, as in ſea-plants; and air, as in ſome mucilages.

As to thoſe few plants which appear to float with the water, their manner of growth is ſomewhat anomalous. M. Tournefort has affirmed that all plants do not ariſe ſtrictly from ſolid ſeeds; but that ſome, inſtead of a ſolid ſemen, depoſite, or let fall a little drop of juice, which ſinking in the water, by its gravity reaches the bottom, or ſome rock, &c. in its way; to which it ſticks, ſtrikes root, and ſhoots into branches: ſuch is the origin of coral.

Add, that the root of a plant may have any ſituation at pleaſure, with reſpect to the body thereof; nor needs it either be loweſt, or higheſt, &c.—Accordingly, in aloes, coral, moſſes, fungus's, &c. the root is frequently uppermoſt, and the growth downwards.

The vaſcular ſtructure of vegetables, is rendered very apparent, by an experiment of Mr. Willughby.—Cutting off ſome pretty big branches of birch, and making a ſort of baſon, or reſervoir on the end thereof with ſoft wax; upon filling this with water, and holding the branch upright, the water, in a few minutes, ſunk into the veſſels of the wood, and running quite through the length, dropped out conſiderably faſt at the other end; continuing ſo to do, as long as the water was poured on.—The ſame ſucceeds, in the ſycamore, walnut-tree, &c. though the flux here is not ſo copious. *Philoſophical Tranſactions*, N°. 70.

There are ſecrets whereby the growth of vegetables is ſurpriſingly promoted. Mr. Boyle mentions a virtuoſo, who entertained his friends at the end of their meal with a ſallad of lettuces, which he ſowed in their preſence, immediately before they ſat down to table.

The chemiſts alſo furniſh us with an extraordinary ſort of what they call vegetables: as, the arbor Dianæ, arbor Martis, &c. In effect, gold, ſilver, iron, and copper, being prepared in aqua-fortis, there riſes out of them a kind of tree, which vegetates, or grows, before the naked eye, and ſpreads into branches, leaves, &c. the whole height of the water; till all the matter is ſpent therein.

The water uſed by many in this proceſs, the chemiſts call flint-water; the ſecret of which has been communicated by Rhodocanaſſes, a Greek chemiſt.

VEGETATION, the act whereby plants, and other living bodies, receive nouriſhment, and grow.

Plants, we learn from the microſcope, conſiſt of different parts, veſſels, &c. analogous to thoſe of animals: and each kind of veſſel is ſuppoſed to be the vehicle of a different humour, or juice, ſecreted from the maſs of

ſap; which is conſidered as the blood, or common fund of them all.

Dr. Grew aſſigns the offices of the ſeveral veſſels: thoſe placed on the inner verge of the back, he calls lymphæducts, and ſuppoſes them deſtined for the conveyance of the moſt aqueous, or watery liquor: theſe Mr. Bradley calls the new forming veſſels, which are annually produced, and help to increaſe the bulk of the tree.

Thoſe in the middle of the bark, Dr. Grew calls lactiferous, or reſiniferous veſſels; their uſe, according to Bradley, is to return the ſuperfluous ſap; theſe veſſels, Grew obſerves, are the principal viſcera of plants; and adds, that as the viſcera of animals are but ſuch veſſels conglomerated; ſo the veſſels of a plant are viſcera drawn out at length.

To the nutrition of plants, as well as that of animals, it ſeems neceſſary that there be a concurrence of two ſpecifically diſtinct fluids; and a learned author maintains an intermixture of two ſuch humours in every part of a tree, like that which we obſerve in linſey-woolſey: every part of ſap being impregnated with other tinctures, and continually filtered from fibres of one kind to thoſe of another. And from this mixture, many of the phænomena of the ripening, odours, colours, &c. are accounted for.

The proceſs of nature, in the vegetation of plants, is very accurately delivered by the excellent Malpighi, to the effect following: the egg, or ſeed, of the plant being excluded out of the ovary, called pod, or huſk, and requiring further foſtering and brooding, is committed to the earth; which having received it into her fertile boſom, not only does the office of incubation, by her own warm vapours and exhalation, joined with the heat of the ſun; but, by degrees, ſupplies what the ſeed requires for its further growth: as abounding every where with canals and ſinuſes, wherein the dew and rain water, impregnated with fertile ſalts, glide, like the chyle and blood in the arteries, &c. of animals. This moiſture, meeting with a new depoſited ſeed, is percolated, or ſtrained through the pores or pipes of the outer rind, or huſk, correſponding to the ſecundines of the fœtuſes, on the inſide whereof lies one or more, commonly two, thick ſeminal leaves, anſwering to the placenta in women, and the cotyledons in brutes.

Theſe ſeed-leaves conſiſt of a great number of little veſiculæ, or bladders, with a tube correſponding to the navel-ſtring in animals. In theſe veſiculæ is received the moiſture of the earth, ſtrained through the rind of the ſeed; which makes a ſlight fermentation with the proper juice before contained therein. This fermented liquor is conveyed by the umbilical veſſel to the trunk of the little plant; and to the gem, or bud, which is contiguous thereto: upon which a vegetation and increaſe of the parts ſucceed.

Such is the procedure in the vegetation of plants: which the illuſtrious author exemplifies in a grain of wheat, as follows: the firſt day the grain is ſown it grows a little turgid; and the ſecundine, or huſk, gapes a little in ſeveral places: and the body of the plant, being continued by the umbilical veſſel to a conglobated leaf, which is called the pulp or fleſh of the ſeed, and is what conſtitutes the flower, ſwells; by which means, not only the gem, or ſprout, which is to be the future ſtem, opens, and waxes green: but the roots begin to bunch out; whence the placenta, or ſeed-leaf, becoming looſe, gapes.

The ſecond day the ſecundine, or huſk, being broke through; the ſtem, or top of the future ſtraw, appears on the outſide thereof, and grows upwards by degrees: in the mean time, the ſeed-leaf guarding the roots, becomes turgid with its veſiculæ; and puts forth a white down. And the leaf being pulled away, you ſee the roots of the plant bare; the future buds, leaves, and reſt of the ſtalk ſtill lying hid. Between the roots and the aſcending ſtem, the trunk of the plant is knit, by the navel-knot, to the flower-leaf; which is very moiſt, tho' it ſtill retains its white colour, and its natural taſte.

The third day, the pulp of the conglobated, or round leaf, becomes turgid with the juice which it has received from the earth, fermenting with its own.

Thus the plant increaſing in bigneſs, and its bud or ſtem becoming taller, from whitiſh, it turns greeniſh: the lateral roots alſo break forth greeniſh, and pyramidal from the gaping ſheath, which adheres cloſely to the plant; and the lower root grows longer, and hairy, with many fibres ſhooting out of the ſame.

Indeed there are hairy fibres hanging all along on all the roots, except on their tips; and theſe fibres are ſeen to wind about the ſaline particles of the ſoil, little lumps of earth, &c. like ivy; whence they grow curled. Above the lateral roots, there now alſo break out two other little ones.

The fourth day, the ſtem mounting upwards, makes a right angle with the ſeminal leaf: the laſt roots put forth more; and the other three, growing larger, are cloathed with more hairs, which ſtraightly embrace the lumps of earth; and where they meet with any vacuity, unite into a kind of net-work. The conglobate, or flower leaf, is now ſofter; and, when bruiſed, yields a white ſweetiſh juice, like barley cream. By ſtripping it off, the root and ſtem of the plant are plainly ſeen, with the intermediate navel-knot, whoſe outer part is ſolid, like a bark, and the inner more ſoft, and medullary.

The fifth day, the ſtalk ſtill riſing, puts forth a permanent, or ſtable leaf, which is green, and folded; the roots grow longer, and there appears a new tumor of a future root: the outer, or ſheath leaf is looſened; and the ſeed-leaf begins to fade.

The ſixth day, the ſtable-leaf being looſened, the plant mounts upwards; the ſheath-leaf ſtill cleaving about it like a bark. The ſeed-leaf is now ſeen ſinuous, or wrinkled, and faded: and this being cut or freed from the ſecundine, the fleſh, or pericarpium, is found of a different texture; the outer part, whereby the outſide of the ſeed or grain is heaved up, being more ſolid; but the inſide veſicular, and filled with moiſture, eſpecially that part next the navel-knot. All the leaves being pulled off, the roots torn, and the flower-leaf removed, the trunk appears; wherein, not far from the roots, the navel-knot bunches out, and is ſolid, and hard to cut: above, there is the mark of the ſheath-leaf, which was pulled off; and underneath, as in an angle, the gem is often hid. The hind part of the plant ſhews the breaking forth of the roots, and likewiſe the faded placenta, &c.

After the eleventh day, the ſeed-leaf, as yet ſticking to the plant, crumpled, and almoſt corrupted; within it is hollow; and about the ſecundine, the mucous, and white ſubſtance of the ſeed, being continued to the navel-knot, forms a cavity. All the roots now becoming longer, put forth new branches out of their ſides: the ſeed-leaf withers, and its veſicles are emptied: the internodes, or ſpaces between the knots, grow ſtronger; new gems appear, and the middle root grows ſeveral inches long.

After a month, the roots and ſtalk being grown much longer, new buds break out at the firſt knot, and little tumors bunch out, which, at length, break into roots.

The great attention of all who ſtudy botany, is at preſent placed on the diſcovery of new plants; but we are yet unacquainted with many peculiarities in the moſt common ones, which may prove not a leſs worthy employment for our thoughts.

The irregularities in the vegetation of the ſeveral parts of plants ſeems a ſubject well deſerving our attention; and Mr. Marchand has laid before us an inſtance of this in one of our moſt vulgar plants, the common garden radiſh.

In the month of July, this gentleman obſerved a plant of this ſpecies, which had accidentally fixed itſelf in an open place, and was then full of flowers and pods. Towards the end of one of the branches, he obſerved a kind of tuberoſity of an oblong ſhape, which looked ſomewhat like one of the pods of the plant, but that it was too long, and was very oddly twiſted and contorted; this daily increaſed in ſize, and in a week was come to its full growth, which was, in the whole, about two inches and a half in length, and three quarters of an inch thick. It was of a very rough and knotty ſurface, and, like the reſt of the ſtalk, had ſeveral pedicles of flowers growing

on each ſide from it; it terminated in a ſmooth end, divided into three parts, which all turned upwards.

The longeſt of theſe points terminated in a green cartilaginous flower of the ſame ſubſtance with the protuberance which produced it; in this were all the regular parts of the flowers of the more perfect kind: there were four leaves which ſerved for a cup; four more within theſe, which repreſented the petals; ſix other ſmall bodies there ſtood in the middle of the flower, which repreſented the ſtamina; and among theſe another body which repreſented the piſtil; ſo that here was, in this irregular vegetation, a repreſentation at large of every part of the perfect flower of the radiſh, excepting only the apices; but theſe were all very different, in their nature and ſtructure, from their ſimilar parts in the natural flowers, being all of a hard, thick, and tough cartilaginous ſubſtance, and in colour of a greeniſh brown.

The ſhorteſt of the three points which terminated this tuberoſity, had alſo at its end a reſemblance of a flower compoſed of all the parts mentioned in the former, and of the ſame colour and ſubſtance with it, only differing in being a little ſmaller: and the third point had no regular reſemblance of a flower, but was of the ſame cartilaginous ſubſtance, and of a ſemi-circular figure, and had its upper ſurface ornamented with ſeveral irregular protuberances. This irregular vegetation remained in vigour till October, when it gradually faded away, and there was no appearance of ſeeds in any part of it.

The radiſh, when its ſtalks are wounded by the pucerons, or other inſects, will often throw out a protuberance of ſome irregular figure; but the reſemblance of flowers in this, was a ſingularity never before obſerved.

To explain this, it will be neceſſary to obſerve, that every organiſed part of a plant contains in it a number of inviſible ſeminal principles, capable of producing plants like that to which they have owed their origin; and this is a truth of which the ſucceeding inſtances will all bring very familiar and obvious proofs.

The graft of a tree, which, from only one ſingle bud, produces a tree like that from which it was taken, certainly acts upon this principle; for the whole tree is quite different from the ſtock on which it is grafted, which ſerves for no other purpoſe but merely to convey to it a proper nutritive juice from the developing its parts.

We very well know, that there are many roots, which being cut into little ſlices of only a quarter of an inch thick, each of theſe will propagate its ſpecies, and ſend up new plants like that which the root belonged to; and, ſome roots being ſplit longitudinally into four quarters, each of theſe will in the ſame manner grow and flouriſh, and ſhoot out roots from one part, and ſtalks from another, ſo as to furniſh perfect plants the ſame year; and how can this be, but by their having been ſeminal points in all theſe pieces and ſections of roots, which being dilated, and put in action by the humidity of the earth, have grown into perfect plants. Several of the bulbous-rooted plants produce off-ſets from the ſeveral ſcales of their roots, and from the ſides of their ſtalks; theſe in three years time produce perfect plants with their flowers; and what are theſe but ſo many ſeminal points ready upon occaſion to be developed?

Nothing is ſo obvious, as that the ſlips or cuttings of trees, when planted in the ground, produce roots in one part, and buds for branches from another, and ſo finally become trees, like thoſe from which they were cut; and this, though the piece that is planted, has no viſible appearance of any bud in any part of it.

We alſo know, from daily experience, that many plants ſhoot out roots from their ſtalks as they grow, and that, though this uſually happens in places where there is ſome ſolid ſubſtance for theſe new roots to faſten themſelves to, yet it happens alſo in ſome plants where there is no ſuch uſe for them; and what are theſe roots in a new part of a plant, but the effect of ſo many ſeminal points, ready to grow, both into roots and into branches, in all thoſe places?

Among the thick and fleſhy-leaved plants, as the opuntia, and other of the ſucculent plants of the Indies, there needs no more to produce a new plant, but to cut off a part of a leaf, and ſtick it into the earth, where it will at once take root, and produce a new plant in a very ſhort time. A thouſand other inſtances of this kind might be given; but theſe may be ſufficient to prove, that there are, in almoſt all parts of plants, certain ſeminal points, which, like the plantula ſeminalis, incloſed in the perfect ſeed of each, need only humidity, and a proper degree of warmth, to develope and unfold themſelves into perfect plants.

We are not therefore to wonder at the imitation of perfection in any irregular productions of vegetables, ſince it appears that there are numbers of perfect plants contained in every part of a growing plant, of the ſame kind. *Mem. Acad. Par.* 1709.

As to the vegetable matter, or the food whereby plants grow, there is ſome doubt about it: the common opinion among naturaliſts, is, that water is the great vegetable food: which ſeems confirmed by an eaſy experiment.

A ſprig of balm, mint, or the like plant, is ſet in a phial of pure water, without any mixture of earth; yet the ſprig grows, and puts forth roots, leaves, and branches.

Agreeable to which, is another famed experiment of Van Helmont; who drying 200 pounds of earth, and planting a willow which weighed five pounds therein, watered it only with rain, or diſtilled water; and to ſecure it from any other earth, covered it with a perforated tin cover: at five years end, weighing the tree, with all the leaves it had borne in that time, he found it to weigh 169 pounds three ounces; yet the earth was only diminiſhed two ounces.

To aſcertain this point, Dr. Woodward has made ſome very good experiments; which, at the ſame time, give light to many other circumſtances of vegetation.—His experiments were moſt of them made with ſprigs of mint, and ſome other plants, nicely weighed, and incloſed in equal glaſs phials, well covered up with parchment; leaving room for the ſtems to aſcend through it; and filled with water: ſome with ſpring-water, others with rain water, others with Thames-water.

At the end of ſeventy-ſeven days he took them all out again; and weighed them, as alſo the water left; and computed the weight of water expended on them, and the proportion of the increaſe of the plant, to the expence of the water.

The next year, he made freſh experiments with the ſame phials, and the ſame ſort of plants, weighed as before, only ſome were filled with another different water alone, others with the ſame water and a certain proportion of garden-earth diſſolved in it; and others in the ſame water diſtilled.

At the end of fifty-ſix days, he weighed the plants, water, &c. and computed what each plant had gained, what quantity of water was expended on the plant, and the proportion of the increaſe of the plant, to the decreaſe of the water.

The reſult of all which experiments, he gives us in the following obſervations, and reflections.—1. In plants of the ſame kind, the leſs they are in bulk, the ſmaller quantity of the fluid maſs, in which they are ſet, is drawn off; the conſumption, where the maſs is of equal thickneſs, being pretty nearly proportional to the bulk of the plant.

In effect, the water ſeems to aſcend up the veſſels of plants, in much the ſame manner as up a filtre: and it is no great wonder, that the larger filtre ſhould draw off more water than the ſmaller; or that a plant, that hath more and larger veſſels ſhould take up a greater ſhare of the fluid, in which it is ſet, than one that has fewer can: nor is this noted with regard to what follows.

2. Much the greater part of the fluid maſs thus drawn off, and conveyed into the plants, does not ſettle or abide there; but paſſes through their pores, and exhales up into the atmoſphere.—That the water, in theſe experiments, aſcended only through the veſſels of the plants, is certain; ſince ſome glaſſes, which had no plants in them, though diſpoſed in like manner as the reſt, remained at the end of the experiment as at firſt, without any diminution of water: and that the greateſt part of it flies off from the plant, into the atmoſphere, is as certain.

The laſt proportion of the water expended, was to the augment of the plant, as 46 or 50 to 1; and in ſome as 100, 200, nay, in one, as 700 to 1.

This ſo continual an emiſſion of water, in ſo great plenty, from the parts of the plants, affords a manifeſt reaſon, why countries that abound with trees, and the larger vegetables eſpecially, ſhould be very obnoxious to damps, great humidity in the air, and more frequent rains, than others that are more open and free. The great moiſture in the air, was a great inconvenience, and annoyance to thoſe who firſt ſettled in America; which, at that time, was overgrown with woods and groves: but as theſe were burned and deſtroyed, to make way for habitations, and culture of the earth; the air mended, and changed into a temper much more ſerene and dry than before.

Nor does this humidity go off pure, and alone, but it uſually carries with it many parts of the ſame nature, with thoſe of which the plant, through which it paſſes, conſiſts: the craſſer, indeed, are not ſo eaſily borne up into the atmoſphere, but are uſually depoſited on the ſurface of leaves, flowers, and other parts of the plants; whence our mannas, or honies, and other gummous exudations of vegetables: but the finer and lighter parts are with greater eaſe ſent up into the atmoſphere; thence they are conveyed to our organs of ſmell, by the air we draw in reſpiration; and are pleaſant or offenſive, beneficent or injurious to us, according to the nature of the plants from which they ariſe. And ſince theſe owe their riſe to the water that aſcends out of the earth, through the bodies of plants; we cannot be far to ſeek for the cauſe, why they are more numerous in the air in wet ſummers, and a greater quantity of odours is found exhaling from vegetables, in warm humid ſeaſons, than in any others.

3. A great part of the terreſtrial matter that is mixed with water, aſcends up into the plant, as well as the water. There was much more terreſtrial matter, at the end of the experiment, in the water of the glaſſes that had no plants in them, than in thoſe which had plants. The garden mould diſſolved in ſome of the glaſſes, was conſiderably diminiſhed, and carried off; nay, the terreſtrial and vegetable matter was borne up in the tubes filled with ſand, cotton, &c. in that quantity, as to be evident, even to ſenſe: and the bodies in the cavities of the other tubes, that had their lower ends immerſed in water, wherein ſaffron, cochineal, &c. had been infuſed, were tinged with yellow, purple, &c. To look abroad a little towards our ſhores, and parts within the verge of the ſea, theſe will preſent us with a large ſcene of plants, that, along with the vegetable, take up into them mere mineral matter alſo, in great abundance; ſuch is our ſea-purſlain, the ſeveral ſorts of algas, of ſamphires, and other marine plants: theſe contain common ſea-ſalt, which is the ſame as the foſſil, in ſuch plenty, as not only plainly to be diſtinguiſhed on the palate, but it may be drawn out of them in conſiderable quantity; nay, ſome affirm, there are plants found that will yield nitre, and other mineral ſalts.

The vegetable matter being very fine and light, is ſurpriſingly apt, and diſpoſed to attend water in all its motions, and follow it into each of its receſſes; as appears not only from the inſtances above alledged, but from many others; percolate it with all the care imaginable, filter it with never ſo many filtrations, yet ſome terreſtrial matter will remain. Dr. Woodward has filtered water through ſeveral ſheets of thick paper, and after that, through very cloſe fine cloth, twelve times doubled; and this over and over, and yet a conſiderable quantity of this matter diſcovered itſelf in the water, after all. Now if it thus paſſes interſtices, that are ſo very ſmall and fine, along with the water, it is the leſs ſtrange, that it ſhould attend it in its paſſage through the ducts and veſſels of plants: it is true, filtering and diſtilling the water, intercepts, and makes it quit ſome of the earthy matter it was before impregnated with; but then, that which continues with the water after this, is fine and light, and ſuch, conſequently, as is, in a peculiar manner, fit for the growth and nouriſhment of vegetables. And this is the caſe of rain water: the quantity of terreſtrial matter it bears up into the atmoſphere, is not great; but what it does bear up, is chiefly of that light kind, or vegetable matter, and that too perfectly diſſolved, and reduced to ſingle corpuſcles, all fit to enter the tubules, and veſſels of plants: on which account it is, that this water is ſo very fertile and prolific.

The reaſon why all the terreſtrial matter mixed with the water, does not aſcend into the plant, is, that the mineral matter makes a great deal of it, which is not only groſs and ponderous, but ſcabrous and inflexible; and ſo not diſpoſed to enter the pores of the roots: beſides, a great many of the ſimple vegetable particles, by degrees, unite, and form ſmall clods, or moleculæ, which ſtick to the extremities of the roots of thoſe plants; and others of them, entangled in a looſer manner, form the nubeculæ, or green bodies ſo commonly obſerved in ſtagnant water: theſe, when thus conjoined, are too big to enter the pores, or aſcend up the veſſels of plants; which ſingly they might have done.

Hence it is, that in agriculture, be the earth never ſo rich, good, and fit for the production of corn, or other vegetables; little will come of it, unleſs the parts of it be ſeparated and looſe: and it is on this account, ſuch pains are beſtowed in the digging, tilling, ploughing, fallowing, harrowing, and breaking the clodded lumps of earth: and it is the ſame way that ſea-ſalt, nitre, and other ſalts, promote vegetation.

Some authors imagine nitre eſſential to plants; and that nothing in the vegetable kingdom is tranſacted without it: but Dr. Woodward aſſures us, that by all the trials he has been able to make, the thing ſeems to him quite otherwiſe: and that when contiguous to the plant, nitre rather deſtroys than nouriſhes it. But nitre, and other ſalts, certainly looſen the earth, and ſeparate the concreted parts thereof; by that means fitting and diſpoſing them to be aſſumed by the water, and carried up into the ſeed or plant, for its formation and increaſe. It is every perſon's obſervation, how apt all ſorts of ſalts are to be wrought upon by moiſture, how eaſily they run with it; and when theſe are drawn off, and have deſerted the lumps wherewith they were incorporated, thoſe muſt moulder immediately, and fall aſunder of courſe: the hardeſt ſtone we meet with, if it happen, as it frequently doth, to have any ſort of ſalt intermixed with the ſand of which it conſiſts, upon its being expoſed to a humid air, in a ſhort time diſſolves and crumbles all to pieces; and much more will clodded earth, or clay, which is not of ſo compact and ſolid a conſtitution.

The ſame way is lime likewiſe ſerviceable in vegetation: the huſbandmen ſay, it does not fatten, but only mellows the ground: by which they mean, it doth not contain any thing in itſelf, that is of the ſame nature with the vegetable mould, or afford any matter fit for the formation of plants, but merely ſoftens, and relaxes the earth; by that means rendering it more capable of entering the ſeeds of vegetables ſet in it, in order to their nouriſhment, than otherwiſe it would have been. The properties of lime are well known, and how apt it is to be put in a ferment, and commotion by water; nor can ſuch commotion ever happen, when lime is mixed with earth, however hard and clodded that may be, without opening and looſening.

4. The plant is more or leſs nouriſhed, in proportion as the water in which it ſtands, contains a greater or ſmaller quantity of proper terreſtrial matter in it. The truth of this propoſition is diſcernible through the whole proceſs of this author's experiments. The mint in one of his glaſſes, was of much the ſame bulk and weight with that of two or three others: but the water in which the firſt was, being river-water, which was apparently ſtored more copiouſly than the others with terreſtrial matter, than the ſpring or rain-water, wherein the others ſtood, occaſioned it to arrive at almoſt double the bulk that either of them had; and with a leſs expence of water too: ſo likewiſe the mint in another glaſs, in whoſe water was diſſolved a ſmall quantity of good garden-mould; though it had the diſadvantage to be leſs, when firſt ſet, than either of the mints, in two other glaſſes, whoſe water was the very ſame with the firſt, only that it had none of the earth mixed with it; yet, in a ſhort time, the plant not only overtook, but much out-ſtripped the others.

The reaſon why the proportion of the increaſe of the plant is limited to the quantity of proper terreſtrial matter in the water, is, that all, even vegetable matter, is not proper for the nouriſhment of every plant: nor do there want good indications, that every kind of vegetable requires a peculiar and ſpecific matter for its formation and nouriſhment; nay, each part of the ſame vegetable: and that there are very many and different ingredients to go to the compoſition of the ſame individual plant. If therefore, the ſoil wherein any vegetable or ſeed is planted, contains all, or moſt of theſe ingredients, and thoſe in due quantity, it will grow and thrive there; otherwiſe it will not: if there be not as many ſorts of corpuſcles, as are requiſite for the conſtitution of the main, and more eſſential parts of the plant, it will not proſper at all; if there are theſe, and not in ſufficient plenty, it will never arrive to its natural ſtature; or if there be any the leſs neceſſary and eſſential corpuſcles wanting, there will be ſome failure in the plant; and it will be defective in taſte, ſmell, colour, or ſome other way.

Indeed, it is inconceivable how one uniform, homogeneous matter, having its principles, or original parts of the ſame ſubſtance, conſtitution, magnitude, figure, and gravity, ſhould conſtitute bodies ſo unlike in all thoſe reſpects, as vegetables of different kinds are; nay, even as the different parts of the ſame vegetable: that one ſhould carry a reſinous, another a milky, a third a yellow, a fourth a red juice in its veins; and one afford a fragrant, another an offenſive ſmell; one be ſweet to the taſte, another acid, bitter, acerb, auſtere, &c. that one ſhould be nouriſhing, another poiſonous; one purging, another aſtringent. And this argument makes equally ſtrong againſt thoſe who ſuppoſe mere water the matter out of which all bodies are formed. A cataputia in one of the glaſſes received but little increaſe, only 3 ½ grains all the while it ſtood, though 2501 grains of water were ſpent upon it: but this might poſſibly be owing, not to the water's wanting matter fit for the nouriſhment of that particular plant, but to the water's being an improper medium for it to grow in: too much of that liquor, in ſome plants, may probably hurry the terreſtrial matter through the veſſels too faſt for them to lay hold of it.

But a farther proof of this doctrine is, that the ſoil once proper for the production of ſome ſort of vegetable, does not always continue to be ſo; but, in a tract of time, loſes its property; and this ſooner in ſome lands, and later in others: if wheat, for example, be ſown upon land proper for that grain, the firſt crop will ſucceed very well, and perhaps the ſecond, and the third, as long as the ground is in heart, as the farmers call it; but in a few years it will produce no more, if ſown with that corn; ſome other grain it may, as barley; and after this has been ſown ſo often, that the land can bring forth no more of it, it may afterwards yield ſome good oats; and perhaps peaſe after them. At length it becomes barren; the vegetative matter that at firſt it abounded with, being reduced by the ſucceſſive crops, and moſt of it borne off: each ſort of grain takes forth that peculiar matter, that is proper for its own nouriſhment. It may be brought to bear another ſeries of the ſame vegetables; but that not till it is ſupplied with a new fund of matter, of the like ſort with what it firſt contained; either by the ground's lying fallow for ſome time, till the rain has poured a freſh ſtock upon it; or by the manuring it. That this ſupply is of the like ſort, is evident from the ſeveral manures found beſt to promote the vegetation; which are, chiefly, either parts of vegetables, or of animals: of animals, we ſay, which either derive their own nouriſhment immediately from vegetable bodies, or from other animals that do ſo; in particular, the blood, urine, and excrements of animals; ſhavings of horn, and hoofs; hair, wool, feathers, calcined ſhells, lees of wine and beer, aſhes of all ſorts of vegetable bodies, leaves, ſtraw, roots, and ſtubble, turned into earth by ploughing, or otherwiſe, to rot and diſſolve there. Theſe are our beſt manures; and being vegetable ſubſtances, when refunded back again into the earth, they ſerve for the formation of other like bodies.

The like is obſervable in gardens, where the trees, ſhrubs, and herbs, after their continuing in one ſtation, till they have derived thence the greater part of the matter fit for their increaſe, will decay, and degenerate; unleſs either freſh earth, or ſome fit manure be applied to them: it is true they may maintain themſelves there for ſome time, by ſending forth roots farther and farther, to an extent all around, to fetch in more proviſion; but, at laſt, they muſt have a freſh ſupply brought to them, or they themſelves muſt be removed or tranſplanted to ſome place better furniſhed with matter for their ſubſiſtence. And accordingly, gardeners obſerve, that plants that have ſtood a long while in a place, have longer roots than uſual; part of which they cut off, when they tranſplant to a freſh ſoil, as not now of any farther uſe to them.

All theſe inſtances point forth a peculiar terreſtrial matter, and not water, for the ſubject to which plants owe their increaſe: were it water only, there would be no need of manures, or tranſplanting; the rain falls in all places, in this field and that, indifferently; and on one ſide of an orchard or garden, as well as another: nor could there be any reaſon, why a tract of land ſhould yield wheat one year, and not the next, ſince the rain ſhowers down alike on each.

5. Vegetables then are not formed of water, but of a certain peculiar terreſtrial matter. A little diſtillation ſhews, that there is a conſiderable quantity of this matter contained both in rain, ſpring, and river-water: and the experiments above-mentioned ſhew, that the much greateſt part of the fluid maſs that aſcends up into plants, does not ſettle or abide there, but paſſes through the pores of them, and exhales into the atmoſphere; and that a great part of the terreſtrial matter, mixed with the water, paſſes up into the plant along with it; and that the plant is more or leſs augmented, in proportion as the water contains a greater or ſmaller quantity of that matter: from all which, we may reaſonably infer, that earth, and not water, is the matter that conſtitutes vegetables.

One of the ſprigs of mint drew up into it 2501 grains of the fluid maſs, and yet had received but 3 ½ grains of increaſe from it: a ſecond, though it had at firſt the diſadvantage to be much leſs than the third, yet, being ſet in water wherewith earth was plentifully mixed, and the other in water, without any ſuch earth, it had vaſtly out-grown it; weighing, at leaſt, 145 grains more than the former: a fourth plant, though at firſt a great deal leſs than the fifth, yet being ſet in the foul craſs-water, that was firſt in the ſtill, after that in which the laſt was ſet was drawn off, had gained in weight, at the end, above double what that in the finer and thinner water had. The proportion of the augment of that plant which throve moſt, was to the fluid maſs ſpent upon it, but as 1 to 46; in others, as 1 to 60, 100, 200; and in the cataputia, but as 1 to 714.—One of the ſprigs took up 39 grains of water a day, one day with another; which was much more than the whole plant weighed originally, and yet it gained not ¼ of a grain a day in weight; and another took up 253 grains a day, which was near twice as much as its original weight; and after all, the daily increaſe of the plant was no more than 2 $\frac{15}{36}$ grains.

6. Spring and rain-water contain near an equal charge of vegetable matter; and river-water more than either of them. Theſe proportions hold in the main, but a ſtrict and juſt compariſon is hardly to be expected, inaſmuch as in all probability, the water that falls in rain, contains at ſome times a greater ſhare of terreſtrial matter, than that which falls at other times; a more powerful and intenſe heat, of neceſſity, hurrying up a larger quantity of that matter, along with the humid vapours that form rain, than one more feeble and remiſs poſſibly can. The water of one ſpring may flow forth with a higher charge of this matter, than that of another: this depending partly upon the quickneſs of the ebullition of the water, and partly upon the quantity of that matter latent in the ſtrata, through which the fluid paſſes, and the greater or leſs laxity of thoſe ſtrata: for the ſame reaſon the water of one river may abound with it, more

than that of another; nay, the ſame river, when much agitated, and in commotion, muſt tear up more of it, than when it moves with leſs rapidity, and violence. That there is a greater quantity of this matter in rivers, and that it contributes vaſtly to the ordinary fertility of the earth, we have an illuſtrious inſtance in the Nile, the Ganges, and other rivers, that yearly overflow the neighbouring plains; their banks producing the faireſt and largeſt crops of any in the world.

7. Water ſerves only for a vehicle to the terreſtrial matter which forms vegetables, and does not itſelf make any addition to them. Where the proper terreſtrial matter is wanting, the plant is not augmented, though never ſo much water aſcend into it: water, then, is not the matter that compoſes vegetable bodies; it is only the agent that conveys that matter to them, and diſtributes it to their ſeveral parts for their nouriſhment: that matter is ſluggiſh and inactive, and would lie eternally confined to its beds of earth, without advancing up into plants; did not water, or ſome like inſtrument, fetch it forth, and carry it into them.

This fluid is capacitated for the office here aſſigned it, ſeveral ways: by the figure of its parts, which, as appears from many experiments, is exactly and mathematically ſpherical; their ſurfaces being perfectly polite, and without any the leaſt irregularities. It is evident, corpuſcles of ſuch a figure are eaſily ſuſceptible of motion, and far above any others whatever; and conſequently are the moſt capable of moving and conveying other matter that is not ſo active: then, the intervals of bodies of that figure, are, with reſpect to their bulk, of all others, the largeſt, and ſo the moſt fitted to receive and entertain foreign matter in them; beſides, as far as the trials hitherto made inform us, the conſtituent corpuſcles of water are each, ſingly conſidered, abſolutely ſolid, and do not yield to the greateſt external force: this ſecures their figure againſt any alteration, and the intervals of the corpuſcle, muſt, for this reaſon, be always alike. By the latter, it will be ever diſpoſed to receive matter into it; and by the former, when once received, to bear it along with it. Water is farther capacitated to be a vehicle to this matter, by the tenuity and fineneſs of the corpuſcles of which it conſiſts: we hardly know any fluid in all nature, except fire, whoſe conſtituent parts are ſo exceeding ſubtile, and ſmall, as thoſe of water are: they will paſs pores and interſtices, that neither air, nor any other fluid will. This enables them to enter the fineſt tubes and veſſels of plants, and to introduce the terreſtrial matter, conveying it to all parts of them; whilſt each, by means of organs it is endued with for the purpoſe, intercepts, and aſſumes into itſelf ſuch particles, as are ſuitable to its own nature, letting the reſt paſs on through the common ducts.

8. Water is not capable of performing this office to plants, unleſs aſſiſted by a due quantity of heat. This muſt concur, or vegetation will not ſucceed. The plants ſet in the glaſſes in October, and the following colder months, had not near the quantity of water ſent up into them, or ſo great an additional increaſe by much, as thoſe that were ſet in June, July, and the hotter months. It is plain, water has no power of moving itſelf, or riſing to the vaſt height it does, in the more tall and lofty plants; ſo far from it, that it does not appear from any diſcovery yet made, that even its own fluidity conſiſts in the inteſtine motion of its parts, whatever the Carteſians think. Indeed, we need nothing more to ſolve all the phænomena of fluidity, than ſuch a figure, and diſpoſition of parts, as water has: ſpherical corpuſcles muſt ſtand ſo very tickliſh upon each other, as to be ſuſceptible of every impreſſion; and though not perpetually in motion, they muſt be always ready and liable to be put into it, by any of the ſlighteſt force imaginable: it is true, the parts of fire, or heat, are not capable of moving themſelves, any more than thoſe of water; but they are more ſubtile, light, and active, than thoſe are, and ſo are more eaſily put into motion.

That the concurrence of heat in this work is really neceſſary, appears not only from the experiments before us, but from all nature; from the fields and foreſts, gardens and orchards: we ſee in autumn, as the ſun's power is gradually leſs and leſs, ſo its effect on plants is remitted, and vegetation ſlackens by little and little. Its failure is firſt diſcernible in trees; which being raiſed higheſt above the earth, require a more intenſe heat, to elevate the water, charged with nouriſhment, to their tops; ſo that for want of freſh ſupport and nutriment, they ſhed their leaves, unleſs ſecured by a firm and hard conſtitution indeed, as our ever-greens are: next the ſhrubs part with theirs; and then the herbs, and lower tribes; the heat being at length, not ſufficient to ſupply even theſe, though ſo near the earth, and the fund of their nouriſhment. As the heat returns the ſucceeding ſpring, they all recruit again, and are furniſhed with freſh ſupplies and verdure: but firſt, thoſe which are loweſt and neareſt the earth, and that require a leſſer degree of heat to raiſe the water with its earthy charge into them; then the ſhrubs, and high vegetables, in their turns; and laſtly, the trees. As the heat increaſes, it grows too powerful, and hurries the matter with too great rapidity, through the finer and more tender plants; theſe, therefore, go off, and decay; and others that are more hardy and vigorous, and require a greater degree of heat, ſucceed in their order. By which mechaniſm, provident nature furniſhes us with a very various and differing entertainment; and what is beſt ſuited to each ſeaſon all the year round.

As the heat of the ſeveral ſeaſons affords us a different face of things, ſo the ſeveral diſtant climates ſhew the different ſcenes of nature, and productions of the earth. The hotter countries ordinarily yield the largeſt and talleſt trees, and thoſe too, in a much greater variety than the colder; even thoſe plants common to both attain to a much greater bulk in the ſouthern than the northern climes: nay, there are ſome regions ſo cold, that they raiſe no vegetables at all to any conſiderable ſize; this we learn from Greenland, Iceland, and other places of like cold ſituation and condition: in theſe there are no trees, and the ſhrubs are poor, little, and low. Again, in the warmer climates, and ſuch as do furniſh trees, and the large vegetables, if there happen a remiſſion, or diminution of the uſual heat, their productions are always impeded in proportion: our cold ſummers give us proof enough of this; for though, at ſuch times, the heat we have is ſufficient to raiſe the vegetative matter into the lower plants, our corns, wheat, barley, peaſe, and the like; and we have plenty of ſtrawberries, raſpberries, gooſeberries, currants, and the fruits of ſuch vegetables as are low and near the earth, and a moderate ſtore of cherries, mulberries, plums, &c. and ſome others that grow at ſomewhat greater height; yet our apples, pears, walnuts, and the productions of the taller trees, have been fewer, and thoſe not ſo thoroughly ripened, and brought to that perfection, as they are in more benign and warm ſeaſons: and, indeed, in trees of the ſame kind, thoſe that keep cloſe to the earth, always produce the moſt and beſt fruit: for which reaſon it is, that the gardeners check and reſtrain the growth of their better fruit-trees, and prevent their running up to too great a height. As to our grapes, apricots, peaches, nectarines, and figs, they being tranſplanted hither out of hotter countries, it is the leſs wonder we have a failure of them in cold ſummers. Nor is it the ſun, or the ordinary emiſſion of the ſubterranean heat only, that promotes vegetation, but any other indifferently, according to its power and degree; as we find from our ſtoves, and hot-beds.

VEGETATIVE, *Vegetativus*, a term applied to that principle or part in plants, by virtue of which they receive nouriſhment, and grow or vegetate.

The philoſophers ſpeak of three kinds of ſouls, the vegetative, ſenſitive, and rational.

The vegetative ſoul is that principle whereby trees and plants live, grow, and produce their kind, &c.

This vegetative principle is differently ſeated in different plants: an ingenious author obſerves, that, generally ſpeaking, its place is exactly between the trunk and root; at leaſt, this appears to be the place in moſt of the ſeminiferous tribe; which, if cut down near the place, rarely ſhoot again.

In other plants, as the elm, and many other edible plants, it ſeems to reſide wholly in the roots; which, if

than that of another; nay, the same river, when much agitated, and in commotion, must tear up more of it, than when it moves with less rapidity, and violence. That there is a greater quantity of this matter in rivers, and that it contributes vastly to the ordinary fertility of the earth, we have an illustrious instance in the Nile, the Ganges, and other rivers that yearly overflow the neighbouring plains; their banks producing the fairest and largest crops of any in the world.

2. Water serves only, for a vehicle to the terrestrial matter which forms vegetables, and does not itself make any addition to them. Where the proper terrestrial matter is wanting, the plant is not augmented, though never so much water ascend into it: was it, then, true, as to the matter that completes vegetable bodies, it is only the agent that conveys that matter to them, and distributes it to their several parts for their nourishment: that matter is sluggish and inactive, and would be eternally confined to the beds of earth, without advancing the plants, did not water, or some like it from other parts, bring forth, and carry it into them.

This fluid is capacitated for the office here assigned it several ways: by the figure of its particles, which appears from many experiments; it is actually spherical; their surface, with which they are surrounded, and by the light particles of air, which are intermixed with it, and by the corpuscles of earth, a figure which is not capable of touching any other in more than a single point, and consequently are the most capable of motion, and separation from each other, that is yet known. Indeed, the particles of water are so very minute, and by the figure above mentioned, so very moveable among one another, that they must be always ready to be put into motion by any of the least forces imaginable: it is set in motion by the rays of light, and by the particles of heat, and is moved with the greatest velocity by the particles of fire, or heat, as they are capable of moving bodies, any more than those of water, but they are more subtile, and active, than those are, and so are more easily put into motion.

That the solution of earth in water is really performed, appears too evidently from the experiments before mentioned, to be called in question. We see in nature, from the fields and downs, great quantities of earth carried off by the rains, and washed into the valleys, and brooks, and rivers, and from thence into the sea, where it subsides, and forms new strata at the bottom. By which mechanism, providence furnishes us with a very various and different soil for the several plants, as best suited to each region and climate, and the fruit of such vegetables as are intended for the food of animals. Thus, by means of the rains, the most unfruitful mountains, and barren rocks, become clothed with herbage, and the driest sands are rendered fertile. Hence, also, the reason why the fruits of the earth, and the fruit of trees, are found in greater perfection in valleys, than on the tops of hills, and mountains, because the former receive the soil washed down from the latter, by the rains.

3. Water is not capable of performing this office to plants, unless attended by a due quantity of heat. If the earth, in the winter season, and the following months, had not near the quantity of heat to it, that is usually found in the summer, and autumn, the greatest quantity of water that could be conveyed to the roots of plants, would be of no service to them, but would be frozen, and rendered incapable of motion. Hence it is, that in the winter season, when the heat is small, and the days short, the sap in trees, and other plants, is in a manner stagnated, and the vegetation of the earth, and plants, is suspended, and almost entirely ceases. But as the heat increases, and the days grow longer, the sap begins to circulate more freely, and the trees, and plants, to bud, and put forth their leaves, which is assisted by a firm and hard condition of the earth, as the ever-greens are; next the fruit trees with theirs; and then the herbs, and lower tribes; the latter being at length, not sufficient to supply even these though to bear the earth, and the fruit of their nourishment. As the heat increases the succeeding springs, the earth again, and are furnished with fresh supplies and verdure, but fruit, those which are lowest and nearest the earth, and that require a less degree of heat to ripen them with its earthy charge into them, those the earth, and high vegetables in their turns, and the tree. As the heat increases, it grows too powerful, and burns the matter with too great rapidity, dries up the more tender plants, shrubs, and trees, and destroys the fruit, and the grass, and herbs, by exhausting the moisture, and causing a remission, or diminution of the vegetations, the productions are always impeded in proportion to the degree of heat, and drought, and ceases entirely, when the heat is so great as to destroy the vegetative power of the plants, and dry up the moisture. By which mechanism, providence furnishes us with a very various and different soil for the several plants, as best suited to each region and climate, and the fruit of such vegetables as are intended for the food of animals. Thus, by means of the rains, the most unfruitful mountains, and barren rocks, become clothed with herbage, and the driest sands are rendered fertile. Hence, also, the reason why the fruits of the earth, and the fruit of trees, are found in greater perfection in valleys, than on the tops of hills, and mountains, because the former receive the soil washed down from the latter, by the rains.

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Fig. 1. Vein.

Fig. 3.

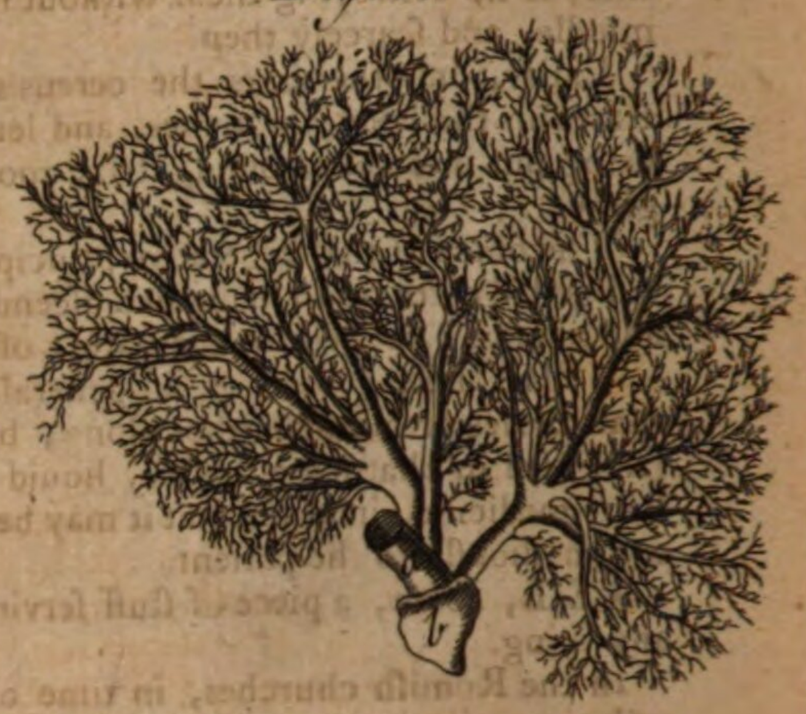

Fig. 4.

Fig. 2.

Fig. 5.

cut into ever ſo many parts, yet thoſe being planted in the ground ſoon grow. In others, as in the willow kinds, it ſeems to be diffuſed all over, both root, trunk, and branches, inſomuch that, if cut into a thouſand pieces, there is no deſtroying them without ſplitting them in the middle, and ſcarcely then.

Laſtly, in others, as the cereus's, ficus's, &c. it is ſeated in the body, branches, and leaves, any of which being put into the ground, ſtrike root immediately, and grow.

The office of this vegetative principle is to concoct the indigeſted earth and ſalts which aſcend through the roots, and to aſſimilate them to the nature of the plant.

VEHICLE, *Vehiculum*, in general, denotes any thing that carries or bears another along; but is more particularly uſed in pharmacy for any liquid ſerving to dilute ſome medicine, in order that it may be adminiſtered more commodiouſly to the patient.

VEIL, *Velum*, a piece of ſtuff ſerving to cover or hide any thing.

In the Romiſh churches, in time of Lent, they have veils or curtains over the altar, crucifix, images of ſaints, &c.

A veil or crape is wore on the head by nuns, as a badge of their profeſſion: the novices wear white veils; but thoſe who have made the vows, black ones.

VEIN, in anatomy, a veſſel which conveys the blood from the artery back to the heart.

The veins are only a continuation of the extreme capillary arteries, reflected back again towards the heart, and uniting their channels, as they approach it, till at laſt they all form three large veins; the cava deſcendens, which brings the blood back from all the parts above the heart; the cava aſcendens, which brings the blood from all parts below the heart; and the porta, which carries the blood to the liver. The coats of the veins are the ſame with thoſe of the arteries, only the muſcular coat is not as thin in all the veins, as it is in the capillary arteries; the preſſure of the blood againſt the ſides of the veins being leſs than that againſt the ſides of the arteries. In the veins there is no pulſe, becauſe the blood is thrown into them with a continued ſtream, and becauſe it moves from a narrow channel to a wider. The capillary veins unite with one another, as has been ſaid of the capillary arteries. In all the veins which are perpendicular to the horizon, excepting thoſe of the uterus and of the porta, there are ſmall membranes or valves; ſometimes there is only one, ſometimes there are two, and ſometimes three placed together, like ſo many half thimbles ſtuck to the ſides of the veins, with their mouths towards the heart. In the motion of the blood towards the heart, they are preſſed cloſe to the ſides of the veins; but, if the blood ſhould fall back, it muſt fill the valves; and they being diſtended, ſtop up the channel, ſo that no blood can repaſs them.

The veins are beſt deſcribed by beginning with their trunks. The trunk of the cava deſcendens joins the trunk of the cava aſcendens, and both together open into the right auricle of the heart. On the inſide of the vein where the trunks join, there is a ſmall protuberance which hinders the blood that comes from the upper parts, from falling upon that from the inferior parts, but diverts both into the auricle, where the cava deſcendens joins the auricle; it receives the coronary vein of the heart. As ſoon as it pierces the pericardium it receives the αζυγος, or vena ſine pari; this vein runs along the right ſide of the vertebræ of the thorax, and is made by the union of the veins of the ribs on each ſide. Its ſmall end at the diaphragma is divided into two branches, which communicate with a vein, ſometimes from the emulgents, and ſometimes from the cava aſcendens. The cava deſcendens receives next the intercoſtalis ſuperior, which is diſtributed in the interſtices of the four firſt ribs to which the azygos comes. Remark, that the branches both of the one and the other run into the ſinus's which are on the lower ſides of the ribs. Sannichellius hath obſerved, that the trunk of the cava deſcendens receives a branch called pneumonica; it is this branch that accompanies the arteria bronchialis of M. Ruyſch. The trunk of the cava deſcendens, as ſoon as it comes to the claviculæ, where it is ſuſtained by the thymus, is divided into two branches; the one goes to the right, and the other to the left; they are called ſubclaviæ, which receive ſeveral other branches: the firſt is the mammaria, which comes, ſometimes, into the cava, before it divides into the ſubclaviæ; this vein is diſtributed in the breaſts, and frequently goes lower, and makes an anaſtomoſis with ſome branches of the epigaſtrica. The ſecond is the mediaſtina, which is ordinarily one opening into the trunk of the cava; it goes to the mediaſtinum and thymus. The third is the cervicalis or vertebralis, which goes up the vertebræ of the neck, and caſts ſome branches, by the bye, to the medulla ſpinalis. The fourth is the muſcula inferior, which comes, ſometimes, into the jugulars; it is diſtributed through the inferior muſcles of the neck, and ſuperior of the breaſt; the branch that anſwers this is called muſcula poſterior, becauſe it is diſtributed in the muſcles which are in the hind part of the neck. After that the rami ſubclavii are come out of the cavity of the breaſt, they are called axillares; they receive the ſcapularis internus and externus, which go to the muſcles of the ſcapula, and to the glands in the arm-pits: then they are divided into two branches; the ſuperior is called cephalica, and the inferior baſilica. Into the baſilica open the thoracica ſuperior, which goes to the dugs and muſcles of the breaſt; and the thoracica inferior, which ſpreads itſelf upon the ſides of the breaſt, by ſeveral branches which communicate by anaſtomoſis with the branches of the azygos under the muſcles of the breaſt. The ſubclavii receive, alſo, the jugulares externi and interni, which go to the head. The jugulares externi aſcend towards the ears, where they divide into two branches, the one internal, the other external. The internal goes to the muſcles of the mouth, and of the os hyoides. The external, lying upon the parotides, divide into two branches, of which one is ſpread through all the face, and the branches on the one ſide unite with thoſe on the other, and form the vena frontis; the other branch goes to the temples and hind-head. The jugulares interni aſcend to the baſis of the cranium, where they are divided into branches, of which the greateſt open into the ſinus lateralis of the dura mater, by the holes through which the eighth pair of nerves come out; the leaſt go to the pia mater, by the hole which is nigh the cella turcica. The baſilica and cephalica are the two principal veins of the arms and hands. The cephalica creeps along the arm between the ſkin and the muſcles: it divides into two branches; the external branch goes down to the wriſt, where it joins the baſilica, and turns up to the back of the head, where it gives a branch, which makes the ſalvatella between the ring finger and the little finger. The ancients uſed to open this vein in diſeaſes of the head, in continued and intermitting fevers; but the moderns approve not of this particular practice; ſince the knowledge of the circulation of the blood, there is no difference whether one be blooded in the cephalica, mediana, or baſilica. The internal branch of the cephalica, together with a branch of the baſilica, makes the mediana. The baſilica, which is the inferior branch of the axillares, divides into three branches under the tendon of the muſculus pectoralis. The firſt branch accompanies the fourth branch of nerves that goes to the arm. The ſecond is called profundus; it reaches below the elbow, where it divides in two branches; the one external, which goes to the thumb, the fore-finger, and to the muſculi extenſores carpi; the other internal, which goes to the middle finger, to the ring finger, to the little finger, and to the inner muſcles of the hand. The third branch is called ſubcutaneus, towards the inner condyle of the arm; it divides into the ramus anterior and poſterior: the firſt goes under the muſcles of the ulna to the little finger, where it joins a branch of the cephalica; the ſecond, near to the elbow, ſends out a branch which goes to the wriſt; then it unites with the cephalica interior, and forms the mediana. The mediana, which is made of the cephalica interior and the ſecond branch of the ramus ſubcutaneus of the baſilica, divides into two branches upon the radius; the one external, called cephalica pollicis, which runs between the thumb and fore-finger; the other internal, which goes between the ring and middle finger, and ſometimes between this laſt and the fore finger. The

trunk,

trunk of the cava aſcendens, between the heart and diaphragma, does not lie upon the vertebræ, but runs at a ſmall diſtance from them. At the diaphragma, it receives the phrenica or diaphragmatica. When it has pierced the diaphragmatica, it receives ſome large branches from the liver; then the cava aſcendens accompanies the great artery from the liver to the fourth vertebræ of the loins, where it divides into two great branches, called iliaci; but before this diviſion, it receives four branches from each ſide. The firſt is the vena adipoſa, or renalis, which is ſpread on the coat and fat that covers the reins. The ſecond is the vena emulgens, which goes to the kidneys, where it divides into ſeveral more branches. The third is the vena ſpermatica: the fourth is the vena lumbaris, which is not always one, but often two or three on each ſide, which they divide into ſuperior and inferior; they are beſtowed on the muſcles of the loins, and on the peritonæum. They ſometimes call the laſt branch of the lumbaris muſcula ſuperior.

There are ſome anatomiſts who have obſerved a branch of the lumbaris which enters the cavity of the vertebræ, and aſcends to the brain; which gave them occaſion to think, againſt all probability, that the ſeed deſcended, by that vein, from the brain. A little below the emulgents, the great artery goes above the cava; and then the cava divides into two branches called iliacæ, becauſe they paſs above the ilia to go to the thighs. Near this diviſion, they receive one or two branches, called venæ ſacræ; they go to the medulla of the os ſacrum. Then the vena iliaca divides into two branches, the one internal, the other external. The internal receives two branches, the muſcula media, which is ſpread thro' the muſcles of the thigh; the hypogaſtrica, which is ſometimes double, and ſpread about the ſphincter of the anus; therefore, it is called the hæmorrhoidalis externa. The hypogaſtrica is ſpread, alſo, upon the body of the bladder, upon the matrix, and its neck. The external branch of the iliaca receives three branches, two before it goes out of the peritonæum, and the third after it goes out of it. The firſt is the vena epigaſtrica, which comes rarely into the cruralis; it goes to the peritonæum, aſcends to the muſculi recti, where it rencounters the mammariæ, with which it communicates by anaſtomoſis. The ſecond is the vena pudenda; it is ſpread upon the parts of generation. The third is the muſcula inferior; it goes towards the articulation of the femur, and is diſtributed to the muſcles of this part. The iliaca exterior, after it has received all theſe branches, takes the name cruralis, and then receives ſix branches more. The firſt is the vena ſaphæna, which goes down under the ſkin along the inſide of the thigh and leg, accompanied by a nerve which loſes itſelf at the inner ankle. The ſaphæna turns towards the upper part of the foot, where it gives ſeveral branches, of which ſome go to the great toe. The ſecond is the iſchias minor; this vein is little; it is ſpent on the muſcles and ſkin, which are about the upper joint of the femur. The third is the muſcula externa, becauſe it goes to the external muſcles of the thigh. The fourth is the poplitæa, made of two different branches united together; it goes ſtraight down by the ham to the heel; it lies pretty deep, upon which account it can hardly be opened. The branches which appear, in this place, are not of this vein. The fifth is the ſuralis, which is pretty big, and divides in two branches, the one external, which is leaſt; the other internal, which is biggeſt. Each of theſe divide again into two more; the one external, the other internal. The ſuralis diſtributes its branches upon the fat of the leg, and makes, with the branches of the poplitæa, all thoſe plexus's of veins which are conſpicuous on the upper part of the foot. The ſixth and laſt branch of the cruralis is the iſchias major, which goes, alſo, to the muſcles and fat of the leg, and is divided, afterwards, into ſeveral branches. In order to give a better idea of the ſeveral veins of the human body, we have given a draught of them, where *a*, *a*, (plate CXXXV. *fig.* 1.) repreſents the orifice of the cava cut from the right auricle; *b*, the deſcending trunk of the cava; *c*, *c*, aſcending trunk; *d*, *d*, ſubclavian veins; *e*, vena azygos; *f*, intercoſtal veins; *g*, mammary veins; *i*, *i*, internal jugulars cut off at the baſis of the ſcull *k*, *k*; *l*, *l*, external jugulars; *m*, right axillary vein; *n*, cephalic vein; *o*, baſilic; *p*, mediana.

Fig. 2. *a*, the bulbous trunk of the vein; *b*, its orifice tied up when cut from the left ventricle of the heart; *c*, left ventricle of the heart; *d*, *d*, *d*, &c. branches and ramifications.

Fig. 3. *a*, repreſents the trunk of the cava; *b*, part of the diaphragm.

Fig. 4. *a*, repreſents the trunk of the pulmonary artery, in the time of exſpiration, cut cloſe to the baſis of the heart; *b*, *b*, its diviſions to the right and left lobes of the lungs; *c*, the canalis arterioſus; *d*, *d*, &c. the extremities of the arteries freed from the veſicles of the lungs, and their inoſculations with the pulmonary veins.

Fig. 5. *a*, repreſents the place where the porta enters the liver; *c*, the umbilical vein turned to a ligament; *d*, the canalis venoſus alſo, become a ligament; *e*, *e*, &c. the extremes of the capillary veins.

VEIN, among miners, is that ſpace which is bounded with woughs, and contains ore, ſpar, canck, clay, chirt, croil, brown-hen, pitcher-chirt, cur, which the philoſophers call the mother of metals, and ſometimes ſoil of all colours. When it bears ore, it is called a quick vein; when no ore, a dead vein.

The veins of mines differ greatly from one another in depth, length, and breadth; ſome ſtretch obliquely, from the ſurface toward the central parts of the earth; and theſe the miners call deep veins; others lie ſhallow and circular, ſo as to encompaſs a large ſpace, and theſe are termed ſpreading veins: others poſſeſs a great part of the ſpace they lie in, both in length and breadth, and theſe are called accumulated veins, being no more than a ſpace poſſeſſed by a large group of foſſils of one kind. To give the complete hiſtory of veins and fibres, which are ſmaller veins, their differences, their directions, their interſtices, their diſcontinuations, their riſings and fallings, and their goodneſs, would be a large work. Let it be obſerved, however, that theſe things ſeem all to proceed in a certain order, though that order, and the laws and rules of it, are not perfectly underſtood, ſo as to afford ſure directions for practice; whence it ſometimes happens, that, after a vein has been ſucceſsfully traced for ſome time, it dips, breaks off, or takes a different courſe, leaving the workmen as it were at a fault.

When the vein is found, a pit is to be ſunk upon it, and a crane fixed at the top of the pit for craning up the ore. Burrows, or adits, are alſo to be cut horizontally through the hill in one or more places, reaching to the mine, and ſerving to wheel out the ore, inſtead of craning it up.

VELAMENTUM BOMBYCINUM, a name which ſome anatomiſts give to the velvet membrane, or inner-ſkin of the inteſtines.

VELARIUS, in antiquity, an officer in the court of the Roman emperors, being a kind of uſher, whoſe poſt was behind the curtain in the prince's apartments; as that of the chancellors was at the entry of the baluſtrade, and that of the oſtiarii at the door. The velarii had a ſuperior of the ſame denomination who commanded them.

VELITES, in the Roman army, a kind of antient ſoldiery, who were armed lightly with a javelin, a caſk, cuiraſſe and ſhield.

VELLEITY, *Velleitas*, in the ſchool-philoſophy, is uſually defined a languid, cold, and remiſs will. Others ſay, it implies an impotency of obtaining what we require. Others will have it a ſlight deſire for ſomething which a perſon does not matter much, or is too indolent to ſeek.

VELLICATION, among phyſicians, the act of twitching. The word is more particularly applied to a ſort of ſudden convulſions that happen to the fibres of the muſcles.

VELOCITY, Swiftneſs, or that affection of motion whereby a moving body is diſpoſed to run over a certain ſpace in a certain time. See MOTION.

For the velocity of falling bodies, ſee the article ACCELERATION.

In the doctrine of fluxions it is uſual to conſider the velocity with which magnitudes flow, or are generated. Thus, the velocity with which a line flows, is the ſame as that of the point, which is ſuppoſed to deſcribe or generate the line. The velocity with which a ſurface flows, is the ſame as the velocity of a given right line, that, by moving parallel to itſelf, is ſuppoſed to generate a rectangle, always equal to the ſurface. The velocity with which a ſolid flows, may be meaſured by the velocity of a given plain ſurface that, by moving parallel to itſelf, is ſuppoſed to generate an erect priſm, or cylinder, always equal to the ſolid. The velocity with which an angle flows, is meaſured by the velocity of a point, ſuppoſed to deſcribe the arc of a given circle, which ſubtends the angle, and meaſures it. All theſe velocities are meaſured at any term of the time of the motion, by the ſpaces which would be deſcribed in a given time, by theſe points, lines, or ſurfaces, with their motions continued uniformly from that term.

The velocity with which a quantity flows, at any term of the time, while it is ſuppoſed to be generated, is called its fluxion.

VELOM, a kind of parchment, finer, evener, and whiter than the common ſort. See PARCHMENT.

VELVET, a rich kind of ſtuff, all ſilk, covered on the outſide with a cloſe, ſhort, fine, ſoft ſhag, the other ſide being a very ſtrong cloſe tiſſue.

The nap or ſhag, called alſo the velveting, of this ſtuff, is formed of part of the threads of the warp, which the workman puts on a long narrow-channeled ruler or needle, which he afterwards cuts, by drawing a ſharp ſteel tool along the channel of the needle to the ends of the warp. The principal and beſt manufactories of velvet are in France and Italy, particularly in Venice, Milan, Florence, Genoa, and Lucca: there are others in Holland, ſet up by the French refugees; whereof that at Harlem is the moſt conſiderable: but they all come ſhort of the beauty of thoſe in France, and, accordingly, are ſold for 10 or 15 per cent. leſs. There are even ſome brought from China, but they are the worſt of all.

There are velvets of various kinds; as plain, that is, uniform and ſmooth, without either figures or ſtripes.

Figured velvet, that is, adorned and worked with divers figures, though the ground be the ſame with the figures; that is, the whole ſurface velveted.

Ramage or branched velvet, repreſenting long ſtalks, branches, &c. on a ſattin ground, which is ſometimes of the ſame colour with the velvet, but more uſually of a different one. Sometimes, inſtead of ſattin, they make the ground of gold and ſilver; whence the denominations of velvets with gold ground, &c.

Shorn velvet, is that wherein the threads, that make the velveting, have been ranged in the channeled ruler, but not cut there.

Striped velvet, is that wherein there are ſtripes of divers colours running along the warp, whether theſe ſtripes be partly velvet, and partly ſattin, or all velveted.

Cut velvet, is that whereon the ground is a kind of taffety, or gros de tours, and the figures velvet.

Velvets are likewiſe diſtinguiſhed, with regard to their different degrees of ſtrength and goodneſs, into velvets of four threads, three threads, two threads, and a thread and a half: the firſt are thoſe where there are eight threads of ſhag, or velveting, to each tooth of the reed; and the ſecond have only ſix, and the reſt four.

In general, all velvets, both worked and cut, ſhorn and flowered, are to have their warp and ſhag of organziſm, ſpun and twiſted, or thrown in the mill; and their woof of ſilk well boiled, &c. They are all of the ſame breadth.

Colour of black VELVET. The manner of giving this deep and fine colour to glaſs is this: take of cryſtalline and pulverine frit, of each twenty pounds; of calx of lead and tin four pounds: ſet all together in a pot in the furnace, well heated. When the glaſs is formed and pure, take ſteel well calcined and powdered, ſcales of iron that fly off from the ſmith's anvil, of each an equal quantity; powder and mix them well; then put ſix ounces of this powder to the above deſcribed metal while in fuſion; mix the whole thoroughly together, and let all boil ſtrongly together; then let it ſtand in fuſion twelve hours to purify, and after this work it. It will be a moſt elegant black. There is another way of doing this, which alſo produces a very fair black. It is this: take an hundred weight of rochetta frit; add to this two pounds of tartar, and ſix pounds of manganeſe, both in fine powder; mix them well, and put them to the metal while in fuſion, at different times, in ſeveral parcels; let it ſtand in fuſion after this for four days, and then work it. *Neri's Art of Glaſs.*

VENAL, or VENOUS, among anatomiſts, &c. ſomething that bears a relation to the veins.

This word is alſo uſed for ſomething bought with money, or procured by bribes.

VENEERING, VANEERING, or FINEERING, a kind of marquetry, or inlaying, whereby ſeveral thin ſlices or leaves of fine woods, of different kinds, are applied and faſtened on a ground of ſome common wood.

There are two kinds of inlaying: the one, which is the moſt common and more ordinary, goes no farther than the making of compartments of different woods; the other requires much more art, in repreſenting flowers, birds, and the like figures.

The firſt kind is properly called veneering; the latter is more properly called marquetry.

The wood uſed in veneering is firſt ſawed out into ſlices or leaves about a line in thickneſs; i. e. the twelfth part of an inch. In order to ſaw them, the blocks or planks are placed upright, in a kind of ſawing preſs. See SAWING-MILL.

Theſe ſlices are afterwards cut into narrow ſlips, and faſhioned divers ways, according to the deſign propoſed; then the joints having been exactly and nicely adjuſted, and the pieces brought down to their proper thickneſs, with ſeveral planes for the purpoſe, they are glued down on a ground or block, with good ſtrong Engliſh glue.

The pieces being thus jointed and glued, the work, if ſmall, is put in a preſs; if large, 'tis laid on a bench covered with a board, and preſſed down with poles or pieces of wood, one end of which reaches to the ceiling of the room, and the other bears on the board.

When the glue is thoroughly dry, it is taken out of the preſs and finiſhed; firſt with little planes, then with divers ſcrapers, ſome of which reſemble raſps, which take off the dents, &c. left by the planes.

After it has been ſufficiently ſcraped, they poliſh it with the ſkin of a ſea-dog, wax and a bruſh, or poliſher of ſhave-graſs; which is the laſt operation.

VENEREAL, ſomething belonging to venery; as the lues venerea, French diſeaſe, or pox. See Pox, GONORRHOEA, &c.

VENERIS OESTRUM, the ſtimulus or incentive of venery, is an appellation given by ſome anatomiſts to the clitoris.

VENERIS OESTRUM is alſo uſed by others for the tranſport of love, or the utmoſt extacy of deſire, or enjoyment, in coition.

VENERY is uſed for the act of copulation, or coition, of the two ſexes. See the article GENERATION.

VENERY alſo denotes the act or exerciſe of hunting wild beaſts, which are alſo called beaſts of venery, and beaſts of the foreſt.

VENESECTION, or PHLEBOTOMY, in ſurgery. See PHLEBOTOMY.

VENETA *Bolus*, the *Venetian bole*, a fine red earth uſed in painting. and called in the colour-ſhops Venetian red. It is improperly denominated a bole, being a genuine ſpecies of red ochre. It is of a fine bright, and not very deep red, approaching, in ſome degree, to the colour of minium, or red-lead, and is moderately heavy, and of an even and ſmooth texture, yet very friable, and of a duſty ſurface: it adheres firmly to the tongue, is very ſmooth and ſoft to the touch, eaſily crumbles to pieces between the fingers, and very much ſtains the ſkin in handling. It has a ſlight aſtringent taſte, and makes no fermentation with acids. It is dug in Carinthia, and ſent from Venice to all parts of the world, being an excellent colour; and very cheap; our colourmen however find many ways of adulterating it.

VENIAL, in the Romiſh theology, a term applied to ſlight ſins, and ſuch as eaſily obtain pardon. In con-

ſeſſing to the prieſts, people are not obliged to accuſe themſelves of all their venial ſins. The thing that gives the greateſt embarras to the Romiſh caſuiſts, is to diſtinguiſh between venial and mortal ſins. The reformed reject this diſtinction of venial and mortal ſins, and maintain, that all ſins, how grievous ſoever, are mortal. And the reaſon they urge is, that all ſins, though of their own nature mortal, yet become venial or pardonable, by virtue of our Saviour's paſſion, to all ſuch as fulfil the conditions on which it is offered in the Goſpel.

VENT, VENT-HOLE, or SPIRACLE, a little aperture left in the tubes or pipes of fountains, to facilitate the air's eſcape; or, on occaſion, to give them air, as in froſty weather, &c. for want of which they are apt to burſt.

Vent is likewiſe applied to the covers of wind furnaces, whereby the air enters, which ſerves them for bellows, and which are ſtopped with regiſters or ſluices, according to the degree of heat required, as in the furnaces of glaſs-houſes, aſſayers, &c.

VENTER, BELLY, in anatomy, a cavity in the body of an animal, containing viſcera, or other organs neceſſary for the performance of divers functions.

Phyſicians divide the human body into three venters, regions, or cavities; the firſt, the head, containing the brain, &c.

The ſecond, the breaſt, or thorax, as far as the diaphragm, containing the organs of reſpiration.

The third, which is what we call the venter, or belly, is that wherein the inteſtines and organs of generation and digeſtion are contained; called, by anatomiſts, the abdomen.

VENTER is alſo uſed in ſpeaking of a partition of the effects of a father and mother, among children born, or accruing from different marriages.

VENTER is alſo uſed for the children whereof a woman is delivered at one pregnancy: thus, two twins are ſaid to be of the ſame venter.

VENTER, or BELLY *of a muſcle*, is the fleſhy or belly-part thereof, as contradiſtinguiſhed from the two tendons, its extremes, one of which is called the head, and the other the tail, of the muſcle.

VENTER DRACONIS, DRAGON'S BELLY, in aſtronomy, denotes the middle of a planet's orbit, or that part moſt remote from the nodes, that is, from the dragon's head and tail; being the part which has the greateſt latitude, or is at the greateſt diſtance from the ecliptic.

VENTIDUCTS, in building, are ſpiracles or ſubterraneous places, where freſh, cool wind being kept, they are made to communicate, by means of tubes, funnels, or vaults, with the chambers or other apartments of a houſe, to cool them in ſultry weather.

VENTILATOR, a machine by which the noxious air of any cloſe place, as an hoſpital, goal, ſhip, chamber, &c. may be changed for freſh air. The noxious qualities of bad air have been long known, though not ſufficiently attended to, in practice; but it is to be hoped that the indefatigable pains taken by Dr. Hales, to ſet the miſchiefs ariſing from foul air in a juſt light, and the remedy he has propoſed by the uſe of his ventilators, will at length prevail over that unaccountable ſloth or obſtinacy, which, where particular intereſts are not concerned, ſeems to poſſeſs the generality of mankind, and which rarely allows them to give due attention to any new diſcovery. The ventilators invented by that ingenious gentleman, conſiſt of a ſquare box, A B C D (plate CXXXIV. *fig.* 5.) about ten feet long, five wide, and two deep; in the middle of which is placed a broad partition, or midriff, made to move up and down, from A to C, on hinges at the end E, by means of an iron rod Z R, fixed to the midriff at Z. Another box, of the ſame ſize with the former, having a like midriff, bar, &c. is placed near the former, (*fig.* 6.) with its rod R Z. Both theſe rods are fixed to a lever F G, moveable on the center O; ſo that by the alternate riſing and depreſſing of the lever F G, the midriffs are alſo raiſed and depreſſed alternately, by which means theſe double bellows are at the ſame time both drawing and pouring out the air. That the midriffs may be rendered lighter, they may be made of four bars lengthwiſe, and as many placed acroſs them, each about three inches broad, and an inch thick, the vacant ſpaces being filled up with thin pannels of firboard.

In order to make the midriffs move with greater eaſe, and without touching the ſides of the boxes, there is an iron regulator N L, (*fig.* 5.) fixed upright to the middle of the end A C of the box. As very little air will eſcape if the edges of the midriff be within one twentieth part of an inch from the ſides of the box, there is no neceſſity for leathern ſides, as in common bellows. The end A C of the box muſt be ſomewhat circular, that it may be the better adapted to the riſing and falling of the midriff; and at the other end of the midriff a ſlip of leather may be nailed over the hinges.

To the ventilators above deſcribed, eight valves are adapted for the air to paſs thro'; theſe valves are placed at the hinge end B Q, (*fig.* 6.) numbered 1, 2, 3, 4, &c. The valve 1 opens inward, to admit the air to enter, when the midriff is depreſſed at the other end, by means of the lever F G; and at the ſame time the valve 3, in the lower ventilator, is ſhut by the compreſſed air, which paſſes out at the valve 4: but when that midriff is raiſed, the valve 1 ſhuts, and the air paſſes out at the valve 2. The ſame is to be obſerved of the valves 5, 6, 7, 8, of the other box; ſo that when by the motion of the lever F G, the midriffs are alternately riſing and falling, then two of the ventilators are conſtantly drawing in the air, and two of them at the ſame time are blowing it out at their proper valves, the air entering at the valves 1, 3, 6, 8, and paſſing out at the valves 2, 4, 5, 7. To the ventilators, before the valves, is fixed a box Q Q M M, (*fig.* 7) as a common receptacle for all the air that comes out of theſe valves, which air is conveyed away through the trunk P, paſſing through the wall of a building, &c

From the foregoing explanation, the nature of ventilators may be eaſily underſtood, and therefore we ſhall be briefer in the following deſcription of thoſe lately erected in Newgate, for exhauſting that priſon of its foul air. In this priſon then there are ſeven ventilators, each nine feet long, and four feet and a half wide; two pair of which are laid on each other; theſe ventilators are worked by means of a wind-mill.

The valves of the ventilators open into a large wooden box A B (*fig.* 8.) which is faſtened to the ventilators by the hooks A A: this box is divided into three ſpaces; the middle, or largeſt, C C, receives all the foul air diſcharged by the ventilators, whence it paſſes through a trunk D D, ſixteen inches wide, through the leads into the open air.

The outer ſpaces B B B B, receive the foul air through the trunks F F, from the ſeveral wards, from whence it is conveyed into the ventilators, through thoſe valves which open inward, and then diſcharged by the other valves of the ventilators, into the middle partition of the box, and from thence conveyed, by the pipe D D, into the open air.

Theſe ventilators are fixed in an upper room of Newgate, in order to be near the leads, where the wind-mill, which works them, is erected; and from each of the outer noſtrils F F, there are trunks, with ſliding ſhutters, paſſing into the ſeveral wards; ſo that by opening theſe trunks, any of the wards may be ventilated, either ſingly, or ſeveral at a time.

That the midriffs may not be ſpoiled for want of air, when all the trunks are ſhut, there are two holes cut in the outer noſtrils, at E E, which are covered with boxes twenty inches long, and fourteen wide. In the bottom of each of theſe boxes is a large moveable valve, of ſuch a weight as not to open but when all the other paſſages for the air are ſtopped; by means of theſe valves, the ventilators are ſupplied with air, when all the trunks, going into the ſeveral wards, are cloſed, and the midriffs are not in danger of breaking for want of it.

The wind-mill (*fig.* 9.) erected for working the ventilators, is deſigned to move with a ſmall degree of wind, that the ventilators may be the oftener worked.

The mill-poſt is fixed on four croſs trees, and ſupported by the braces *u w x y*.

This

This poſt is hollow, that the iron rod *a*, may paſs through, the lower end of it being fixed to the lever of the ventilators.

The upper end of this rod goes to the iron axle-tree, which has a crank ſix inches long, and therefore gives a ſtroke of thirteen inches; and the other end being fixed to the lever, at a proper diſtance from the center of its motion, raiſes the midriffs fifteen inches.

The iron axle-tree extends about two feet beyond the face of the ſails, from the extremity of which, *p*, eight iron braces go to the vanes, *m*, *n*, *o*, *p*, *q*, *r*, *s*, &c.

The frame turns on the poſt, on friction-wheels, ſo that the ſails always face the wind, by means of the vane *i*; *l* is the break-pole, which, by pulling the rope *k*, ſtops the mill; *b*, *d*, *c*, *e*, are iron braces, faſtened at each end with iron bolts, to keep the frame from wracking. See the article WIND-MILL.

Fig. 10. repreſents an inſtrument invented for going with ſafety into damps, and other noxious air. X Z repreſents a ſquare piece of elder, or willow, a foot long, and two inches both in breadth and depth, with a hole, K L Q U, five eighths of an inch diameter, bored thro' it; and, at C D, ſhort foſſets, with like holes bored through them; to which foſſets hollow reed-canes are to be fixed by means of ſhort ſupple leathern pipes, ſo as to be flexible at theſe joints. N, T, S, are ſquare holes, two inches deep, and an inch and three quarters wide, with their leathern covers F, G, H, I, nailed over them. I N is a broad leathern valve, moving on joints at I, ſo as to open, by the force of the air, which paſſes down the pipe B K L, when the breath is drawn in at the mouth at the middle foſſet, which ſtands five eighths of an inch above G H. G S is another like valve, which ſhuts the hole, at Q, cloſe, while the breath is drawing in, through the middle foſſet; but when, on the contrary, the perſon breathes out through the middle foſſet; the valve I N cloſes the hole L, and the other valve G S opens for the breath to paſs freely off through the pipe U A; by which means the perſon always draws in freſh air. There are two ſtiff wires, as T, fixed to prevent the valves opening too far, leſt the force of the breath, which is but ſmall, ſhould not ſhut them: this inſtrument is to be fixed to the mouth by a tape, or cord, tied round the head; and it will be convenient to have cuſhions at the corners C and D, for the cheeks to bear off a part of the preſſure. By the help of this inſtrument a perſon may go into a ſuffocating air, as in ſome mines, &c. his noſtrils being ſtopped with cotton, without any danger of ſuffocation.

VENTRICLE, *Ventriculus*, properly denotes any little cavity; but is more particularly uſed, by phyſicians and anatomiſts, for the ſtomach. See STOMACH.

For thoſe cavities of the heart and brain, called ventricles, ſee HEART and BRAIN.

VENTRILOQUOUS, a term applied to perſons who ſpeak inwardly, having a peculiar art of forming ſpeech, by drawing the air into the lungs; ſo that the voice proceeding out of the thorax, to a by-ſtander ſeems to come from a diſtance.

The word is compounded of *venter*, belly, and *loquor*, I ſpeak.

Such a perſon we had ſometime ago in London, a ſmith by profeſſion, who had the faculty in ſuch perfection, that he could make his voice appear, now, as if it came out of the cellar; and the next minute, as if in an upper room; and no body preſent could perceive that he ſpoke at all: accordingly, he has frequently called a perſon firſt up, then down ſtairs; then out of doors, hen this way, then that, and all this without ſtirring from his ſeat, or appearing to ſpeak at all.

VENTURINE, or ADVENTURINE, is ſometimes uſed for the fineſt and ſlendereſt gold wire uſed by embroiderers. See WIRE.

VENUS, in aſtronomy, one of the inferior planets, revolving round the ſun, in an orbit between that of Mercury and the earth.

Venus is computed to be fifty-nine millions of miles from the ſun; and by moving at the rate of 69,000 miles every hour in her orbit, ſhe goes round the ſun in 224 days, 17 hours, of our time nearly; in which, though it be the full length of her year, ſhe has only 9 $\frac{1}{4}$ days, according to Bianchini's obſervations; ſo that in her every day and night together is as long as 24 $\frac{1}{3}$ days and nights with us. This odd quarter of a day in every year makes every fourth year a leap-year to Venus; as the like does to our earth. Her diameter is 7906 miles; and by her diurnal motion the inhabitants about her equator are carried 43 miles every hour; beſides the 69,000 above mentioned.

Her orbit includes that of Mercury within it; for at her greateſt elongation, or apparent diſtance from the ſun, ſhe is 96 times his breadth from his center; which is almoſt double of Mercury's. Her orbit is included by the earth's; for if it were not, ſhe might be ſeen as often in oppoſition to the ſun as in conjunction with him; but ſhe was never ſeen 90 degrees, or a fourth part of a circle, from the ſun.

When Venus appears weſt of the ſun, ſhe riſes before him in the morning, and is called the morning ſtar: when ſhe appears eaſt of the ſun, ſhe ſhines in the evening after he ſets, and is then called the evening-ſtar: being each in its turn for 290 days. It may perhaps be ſurpriſing at firſt, that Venus ſhould keep longer on the eaſt or weſt of the ſun than the whole time of her period round him. But the difficulty vaniſhes when we conſider that the earth is all the while going round the ſun the ſame way, tho' not ſo quick as Venus: and therefore her relative motion to the earth muſt in every period be as much ſlower than her abſolute motion in her orbit, as the earth during that time advances forward in the ecliptic; which is 220 degrees. To us ſhe appears through a teleſcope in all the various ſhapes of the moon.

The axis of Venus is inclined 75 degrees to the axis of her orbit; which is 51 $\frac{1}{2}$ degrees more than our earth's axis is inclined to the axis of the ecliptic: and therefore the variation of her ſeaſons is much greater than of ours. The north pole of her axis inclines toward the 20th degree of Aquarius, our earth's to the beginning of Cancer: and therefore the northern parts of Venus have ſummer in the ſigns where thoſe of our earth have winter, and *vice verſa*.

The artificial day at each pole of Venus is as long as 112 $\frac{1}{2}$ natural days on our earth,

The ſun's greateſt declination on each ſide of her equator amounts to 75 degrees; therefore her tropics are only 15 degrees from her poles; and her polar circles as far from her equator. Conſequently, the tropics of Venus are between her polar circles and her poles; contrary to what thoſe of our earth are.

As her annual revolution contains only 9 $\frac{1}{4}$ of her days, the ſun will always appear to go through a ſign, or twelfth part of her orbit, in little more than three quarters of her natural day, or nearly in 18 $\frac{1}{4}$ of our days and nights.

Becauſe her day is ſo great a part of her year, the ſun changes his declination in one day ſo much, that if he paſſes vertically, or directly over head of any given place on the tropic, the next day he will be 26 degrees from it: and whatever place he paſſes vertically over when in the equator, one day's revolution will remove him 36 $\frac{1}{4}$ degrees from it. So that the ſun changes his declination every day in Venus about 14 degrees more at a mean rate, than he does in a quarter of a year on our earth. This appears to be providentially ordered, for preventing the too great effects of the ſun's heat, which is twice as great on Venus as on the earth; ſo that he cannot ſhine perpendicularly on the ſame places for two days together; and by that means, the heated places have time to cool.

If the inhabitants about the north pole of Venus fix their ſouth, or meridian line, through that part of the heavens where the ſun comes to his greateſt height, or north declination, and call thoſe the eaſt and weſt points of their horizon, which are 90 degrees on each ſide from that point where the horizon is cut by the meridian line, theſe inhabitants will have the following remarkables.

The ſun will riſe 22 $\frac{1}{2}$ degrees north of the eaſt, and going on 112 $\frac{1}{2}$ degrees, as meaſured on the plane of the horizon, he will croſs the meridian at an altitude of 12 $\frac{1}{2}$ degrees; then making an entire revolution without ſetting, he will croſs it again at an altitude of 48 $\frac{1}{2}$ degrees; at the next revolution he will croſs the meridian as he comes

comes to his greateſt height and declination, at the altitude of 75 degrees; being then only 15 degrees from the zenith, or that point of the heavens which is directly over head: and thence he will deſcend in the like ſpiral manner; croſſing the meridian firſt at the altitude of 48 ½ degrees; next at the altitude of 12 ½ degrees; and going on thence 112 ½ degrees, he will ſet 22 ½ degrees north of the weſt; ſo that, after having been 4 ⅝ revolutions above the horizon, he deſcends below it to exhibit the like appearances at the ſouth pole.

At each pole, the ſun continues half a year without ſetting in ſummer, and as long without riſing in winter; conſequently the polar inhabitants of Venus have only one day and one night in the year; as it is at the poles of our earth. But the difference between the heat of ſummer and cold of winter, or of mid-day and midnight, on Venus, is much greater than on the earth: becauſe in Venus, as the ſun is for half a year together above the horizon of each pole in its turn, ſo he is for a conſiderable part of that time near the zenith; and during the other half of the year, always below the horizon, and for a great part of that time at leaſt 70 degrees from it. Whereas, at the poles of our earth, although the ſun is for half a year together above the horizon, yet he never aſcends above, nor deſcends below it, more than 23 ½ degrees. When the ſun is in the equinoctial, or in that circle which divides the northern half of the heavens from the ſouthern, he is ſeen with one half of his diſc above the horizon of the ſouth pole; ſo that his center is in the horizon of both poles: and then deſcending below the horizon of one, he aſcends gradually above that of the other. Hence, in a year, each pole has one ſpring, one harveſt, a ſummer as long as them both, and a winter equal in length to the other three ſeaſons.

At the polar circles of Venus, the ſeaſons are much the ſame as at the equator, becauſe there are only 15 degrees betwixt them: only the winters are not quite ſo long, nor the ſummers ſo ſhort: but the four ſeaſons come twice round every year.

At Venus's tropics, the ſun continues for about fifteen of our weeks together without ſetting in ſummer; and as long without riſing in winter. Whilſt he is more than 15 degrees from the equator, he neither riſes to the inhabitants of the one tropic, nor ſets to thoſe of the other: whereas, at our terreſtrial tropics he riſes and ſets every day of the year.

At Venus's tropics, the ſeaſons are much the ſame as at her poles; only the ſummers are a little longer, and the winters a little ſhorter.

At her equator, the days and nights are always of the ſame length; and yet the diurnal and nocturnal arches are very different, eſpecially when the ſun's declination is about the greateſt: for then, his meridian altitude may ſometimes be twice as great as his midnight depreſſion, and at other times the reverſe. When the ſun is at his greateſt declination, either north or ſouth, his rays are as oblique at Venus's equator, as they are at London on the ſhorteſt day of winter. Therefore, at her equator there are two winters, two ſummers, two ſprings, and two autumns every year. But becauſe the ſun ſtays for ſome time near the tropics, and paſſes ſo quickly over the equator, every winter there will be almoſt twice as long as ſummer: the four ſeaſons returning twice in that time, which conſiſts only of 9 ¼ days.

Thoſe parts of Venus which lie between the poles and tropics, and between the tropics and polar circles, and alſo between the polar circles and equator, partake more or leſs of the phænomena of theſe circles, as they are more or leſs diſtant from them.

From the quick change of the ſun's declination it happens, that when he riſes due eaſt on any day, he will not ſet due weſt on that day, as with us; for if the place where he riſes due eaſt be on the equator, he will ſet on that day almoſt weſt-north-weſt; or about 18½ degrees north of the weſt. But if the place be in 45 degrees north latitude, then on the day that the ſun riſes due eaſt he will ſet north-weſt by weſt, or 33 degrees north of the weſt. And in 62 degrees north latitude when he riſes in the eaſt, he ſets not in that revolution, but juſt touches the horizon 10 degrees to the weſt of the north point; and aſcends again, continuing for 3¼ revolutions above the horizon without ſetting. Therefore, no place has the forenoon and afternoon of the ſame day equally long, unleſs it be on the equator or at the poles.

The ſun's altitude at noon, or any other time of the day, and his amplitude at riſing and ſetting, being ſo different at places on the ſame parallels of latitude, according to the different longitudes of thoſe places, the longitude will be almoſt as eaſily found on Venus as the latitude is found on the earth: which is an advantage we can never enjoy, becauſe the daily change of the ſun's declination is by much too ſmall for that purpoſe.

On this planet, wherever the ſun croſſes the equator in any year, he will have 9 degrees of declination from that place on the ſame day and hour next year; and will croſs the equator 90 degrees farther to the weſt; which makes the time of the equinox a quarter of a day, almoſt equal to ſix of our days, late every year. Hence, although the ſpiral in which the ſun's motion is performed, be of the ſame ſort every year, yet it will not be the very ſame, becauſe the ſun will not paſs vertically over the ſame places till four annual revolutions are finiſhed.

We may ſuppoſe that the inhabitants of Venus will be careful to add a day to ſome particular part of every fourth year; which will keep the ſame ſeaſons to the ſame days. For, as the great annual change of the equinoxes and ſolſtices ſhifts the ſeaſons a quarter of a day every year, they would be ſhifted though all the days of the year in 36 years. But by means of this intercalary day, every fourth year will be a leap-year; which will bring her time to an even reckoning, and keep her calendar always right.

Venus's orbit is inclined 3 ½ degrees to the earth's; and croſſes it in the 14th degree of Gemini and of Sagittarius; and therefore, when the earth is about theſe points of the ecliptic at the time that Venus is in her inferior conjunction, ſhe will appear like a ſpot on the ſun, and afford a more certain method of finding the diſtances of all the planets from the ſun than any other yet known. But theſe appearances happen very ſeldom; and will only be twice viſible at London for 300 years to come. The firſt time will be in 1996, June the 9th, at 2 hours 13 minutes in the afternoon. And the ſecond in the year 2004, June the ſixth, at 7 hours 18 minutes in the forenoon. Excepting ſuch tranſits as theſe, ſhe ſhews the ſame appearances to us regularly every eight years; her conjunctions, elongations, and times of riſing and ſetting being very nearly the ſame, on the ſame days, as before.

Venus may have a ſatellite or moon, although it be undiſcovered by us: which will not appear very ſurpriſing, if we conſider how inconveniently we are placed for ſeeing it. For its enlightened ſide can never be fully turned towards us but when Venus is beyond the ſun; and then, as Venus appears little bigger than an ordinary ſtar, her moon may be too ſmall to be perceptible at ſuch a diſtance. When ſhe is between us and the ſun, her full moon has its dark ſide towards us; and then we cannot ſee it any more than we can our own moon at the time of change. When Venus is at her greateſt elongation, we have but one half of the enlightened ſide of her full moon towards us; and even then it may be too far diſtant to be ſeen by us. But if ſhe has a moon, it may certainly be ſeen with her upon the ſun, in the year 1996, unleſs its orbit be conſiderably inclined to the ecliptic: for if it ſhould be in conjunction or oppoſition at that time, we can hardly imagine that it moves ſo ſlow as to be hid by Venus all the ſix hours that ſhe will appear on the Sun's diſc.

VENUS, in chemiſtry, the ſame with copper. See COPPER.

VERATRUM, white hellebore, in botany, a genus of plants producing hermaphrodite and male flowers on the ſame plant, each containing ſix oblong, lanceolated, preſiſtent petals, with ſix ſubulated filaments topped with quadrangular antheræ; the male flower is barren, but the hermaphrodite is ſucceeded by three oblong, erect, compreſſed capſules, each having but one cell, containing many oblong, compreſſed, membranaceous ſeeds.

White

White hellebore root is oblong and tuberoſe, duſky without and white within, with a great number of whitiſh fibres; the leaves are oblong, oval, large, rounded at their extremities, and have many longitudinal plaits; the ſtalks riſe to about three or four feet high, branching out on every ſide; under each branch is placed a narrow plaited leaf; the branches and ſtalk are terminated with ſpikes of flowers, which appear in June and July. It grows naturally in ſeveral parts of Germany and Switzerland; the root is the only part uſed in medicine; the taſte is acrid, a little bitteriſh, ſubaſtringent, diſagreeable and nauſeous; the inward uſe is not very ſafe, nor indeed the outward; for when the powder is applied to an iſſue, it will occaſion violent purging; when taken inwardly, it is a ſtrong emetic, and has been obſerved ſometimes to occaſion convulſions and other terrible diſorders; however, in deſperate caſes, it may be ſometimes ventured upon, particularly againſt madneſs: the doſe in this diſeaſe is a ſcruple; though even in this caſe it muſt be uſed with the utmoſt caution. See HELLEBORE.

VERB, in grammar, a word ſerving to expreſs what we affirm of any ſubject, or attribute to it; or, according to others, it is a word principally uſed to ſignify the affirmation, and ſhews that the diſcourſe, wherein it is uſed, is that of a man, who not only has a conception of things, but judges or affirms ſomething of them: though it is principally uſed in this ſenſe, yet it is made uſe of alſo to ſignify other motions of the ſoul, as to deſire, to pray, to command; but this it only does by changing the mood or inflexion.

The verb, in its primary ſignification, ſhould have no other uſe, but to mark the connection which we make in the mind, between the two terms of a propoſition; but the *eſſe*, *to be*, is the only one that has retained this ſimplicity; nor, in ſtrictneſs, has this retained it, but in the third perſon, as *eſt*, *is*. Men being naturally inclined to ſhorten their expreſſions, to the affirmation they have almoſt always added other ſignifications, in the ſame word, ſo as that two words make a propoſition; as in *Petrus vivit*, *Peter lives*; where *vivit* includes both the attribute and affirmation; it being the ſame thing to ſay, *Peter lives*, as that *Peter is living*; and hence the great variety of verbs in every language.

To conſider ſimply what is eſſential to a verb, the only true definition is, a word ſignifying an affirmation; but if we ſhould chuſe to add its principal accidents, it may be defined thus; a word which ſignifies affirmation, with the deſignation of perſon, number, and time.

Verbs are variouſly divided; with reſpect to the ſubject, they are divided into active, paſſive, neuter, &c. with reſpect to their inflections, into regular, irregular, perſonal, imperſonal, auxiliary, ſubſtantive, &c.

A verb active is a verb which expreſſes an action that falls on another ſubject or object; ſuch as, *I love*, *I work*, &c. which ſignify the action of loving, working, &c. Of theſe there are three kinds; the one called tranſitive, where the action paſſes to a ſubject different from the agent; and reflected, where the action returns upon the agent; and reciprocal, where the action returns mutually upon the two agents that produced it.

A verb paſſive is that which expreſſes a paſſion, or which receives the action of ſome agent; and which is conjugated in the modern tongues, with the auxiliary verb *I am*, *je ſuis*.

A verb neuter, is that which ſignifies an action that has no particular object whereon to fall, but which of itſelf takes up the whole idea of the action, as, *I ſleep*, *thou yawneſt*, *he ſnores*, *we walk*, *you run*, *they ſtand*: the Latins called them neuters, becauſe they are neither active nor paſſive, though they have the force and ſignification of both.

Of theſe verbs, ſome form their tenſes by the auxiliary verb *to have*, as *I have ſlept*, *ye have run*; and they are called neuter actives. There are others which form their compound parts by the auxiliary *to be*, as *I am come*; theſe are called neuters paſſive.

A verb ſubſtantive is that which expreſſes the being or exiſtence of a thing, as *I am*, *thou art*.

Auxiliary or helping verbs, are thoſe which ſerve in conjugating active and paſſive verbs, ſuch as *I am*, *I have*, &c.

Verbs in Engliſh, and moſt modern tongues, do not change their terminations, as in Latin, to expreſs the ſeveral times, modes, &c. but they make uſe of auxiliaries, as *have*, *am*, *be*, *do*, *will*, *ſhall*, &c.

Regular verbs are thoſe which are conjugated after ſome one manner, rule, or analogy.

Irregular or anomalous verbs, are ſuch as have ſomething ſingular in the terminations or formations of their tenſes.

Verbs imperſonal are thoſe which have only the third perſon, as *it behoves*, &c.

VERBAL, ſomething that belongs to verbs, or even to words of any kind ſpoken with the mouth.

Thus, verbal nouns, among grammarians, are thoſe formed of verbs.

Again, a verbal contract is one made merely by word of mouth, in oppoſition to that made in writing.

VERBASCUM, mullein, in botany, a plant, all over white and woolly; with a ſingle woody ſtalk, clothed with oblong oval leaves joined to it without pedicles, bearing on the top a long ſpike of large yellow monopetalous flowers cut into five ſegments, and followed by conical ſeed veſſels. It is biennial, grows wild by road ſides, and flowers in July.

The leaves of mullein, recommended as mild aſtringents, have a roughiſh drying kind of taſte, and very little ſmell. The flowers have alſo a ſlight roughiſhneſs, with a conſiderable ſweetneſs.

VERBENA, vervain, in botany, a genus of plants, with wrinkled, oblong, obtuſe leaves, deeply jagged and indented, ſet in pairs on the ſtalks, the upper ones divided into three ſegments: on the tops of the branches appear irregularly labiated blue flowers, in long ſpikes, without any leaves among them, followed each by four ſeeds incloſed in the cup. It is annual, grows wild in uncultivated places, and flowers in July or Auguſt.

This plant has been celebrated for abundance of virtues, for which its ſenſible qualities afford little or no foundation. It has no remarkable ſmell, and hardly any taſte.

VERBERATION, *Smiting*, in phyſics, a term uſed to expreſs the cauſe of ſound, which ariſes from a verberation of the air, when ſtruck in divers manners by the ſeveral parts of the ſonorous body firſt put into a vibratory motion.

VERDEGREASE, or VERDEGRIS, a kind of copper corroded by a fermented vegetable acid into a bluiſh green ſubſtance. The greateſt quantities are prepared about Montpelier, by ſtratifying copper plates with grape-ſtalks, that have been previouſly ſoaked in ſtrong wine, and expoſed to its vapour during a ſecond fermentation of the wine continued to an acetous ſtate: the ſubtile acid, with which the ſtalks are thus impregnated, corrodes the ſurface of the plates, in a few days, into verdegris: which is afterwards ſcraped off, moiſtened, and packed up in ſkins. The maſſes, as brought to us, have generally ſome grape ſtalks intermixed: theſe may be ſeparated by pulverization, as being leſs pulverable than the verdegris itſelf. The goodneſs of verdegris is judged of from the deepneſs and brightneſs of its colour, its dryneſs, and its forming, when rubbed on the hand with a little water or ſaliva, a ſmooth paſte free from grittineſs.

This concrete is partially diſſoluble in water and in rectified ſpirit, and almoſt totally in vinegar: from the acetous ſolution duly inſpiſſated and ſet to ſhoot, greateſt part of the verdegris may be recovered in a cryſtalline form. The cryſtals, diſtilled with a ſuitable fire, in a retort or other like veſſel, give over the acetous acid, in a highly concentrated ſtate, but ſomewhat altered by the proceſs.

Verdegris is employed externally for deterging foul ulcers and as an eſcharotic. Hoffmann recommends it particularly for deſtroying the calloſities of old fiſtulæ: tents of powdered verdegris, made up with ſaliva, or other liquids not fat or oily, exede, he ſays, the hardeſt callus, in three or four days, ſo as to render it completely ſeparable. A detergent ointment is commonly prepared, by gently boiling five parts of verdegris in fine powder, with ſixteen of honey and ſeven of vinegar, till reduced to a due conſiſtence. On keeping this mix-

ture for ſome time, a thick matter, containing greateſt part of the verdegris, falls to the bottom, and a thinner floats on the top: this laſt is the part made uſe of, unleſs where particular occaſions require it to be rendered more acrid by ſhaking up the thick among it. When theſe kinds of applications are employed for venereal or other ulcerations in the mouth and tonſils, great caution is requiſite, on the part of the patient, to guard againſt any portion of them paſſing into the ſtomach; an accident which has ſometimes happened, particularly in childrens caſes, and produced very dangerous and even fatal conſequences.

Verdegris is rarely or never given internally. Some recommend it indeed, in the doſe of a grain or two, as an emetic, which operates almoſt as ſoon as received into the ſtomach, and which may therefore be of uſe, where poiſonous ſubſtances have been taken, to procure their immediate rejection. It appears, however, highly imprudent, to have recourſe, on ſuch occaſions, to a remedy in itſelf ſo dangerous and ſo virulent; and more eſpecially as a ſpeedy evacuation may generally be obtained, by means of ſubſtances, which are not only innocent, but at the ſame time weaken the force of the poiſon by diluting and obtunding it; as warm water, milk, oils.

VERDERER, or VERDEROR, a judicial officer of the king's foreſt, whoſe buſineſs it is to look to the vert, and ſee it well maintained.

VERDICT, is the anſwer of the jury given to the court, concerning the matter of fact, in any caſe civil or criminal, committed by the court to their trial and examination.

A verdict is either general or ſpecial. A general verdict is that which is brought into the court in like general terms as the general iſſue, as, in an action of diſſeiſin, the defendant pleads no wrong, no diſſeiſin. Then the iſſue is general, whether the fact be wrong or not, which being committed to the jury, they, upon conſideration of the evidence, come in and ſay, either for the plaintiff, that it is a wrong diſſeiſin; or for the defendant, that it is no wrong diſſeiſin.

A ſpecial verdict, is, when they ſay at large, that ſuch and ſuch a thing they found to be done by the defendant or tenant; declaring the courſe of the fact, as in their opinion it is proved; and praying the judgment of the court, as to what is law in that caſe.

It is ſaid, that a jury may give a general or ſpecial verdict, in all actions, and caſes; and that the court is obliged to receive it, provided it be pertinent to the point in iſſue: alſo if the jury will take upon them to bring in any thing that is matter of law, their verdict ſhall be received.

Verdicts are alſo public and private; public, when the ſame are given in open court; and private, when given out of court, before any of the judges: but a private verdict, in ſtrictneſs, is looked upon to be no verdict.

VERDITER, or VERDETER, a kind of mineral ſubſtance, ſometimes uſed by the painters, &c. for a blue; but more uſually mixed with a yellow for a green colour.

Verditer, according to Savary, ought to be made of the lapis armenus; or at leaſt of an earthy ſubſtance much like it, brought from the mountains of Hungary, &c. only prepared by powdering it, and cleanſing it by lotion.

But this ſtone being very rare, the verditer commonly uſed is not a native, but a factitious, ſubſtance; which ſome ſay is prepared by caſting wine or water upon new copper, as it comes red hot out of the furnace, and catching the ſteams that riſe from it upon copper-plates; others again ſay, it is prepared by diſſolving copper-plates in wine, much after the manner of verdegreaſe.

But the method of making it in England is as follows:

The refiners pour their copper-water into an hundred pound weight of whiting, ſtirring them well together every day for ſome hours, till the water grows pale; then they pour that off, and ſet it by for further uſe, and pour on more of the green water, repeating this till the verditer is made; which they then take out, and lay on large pieces of chalk in the ſun to dry.

The water which is poured off from the verditer, which remains at the bottom of the tub, is put into a copper, and boiled till it comes to the conſiſtence of water-gruel; now, conſiſting principally of ſalt-petre reduced, moſt of the ſpirit of vitriol being gone with the copper into the verditer; and a diſh full of this being put into the other materials for aqua-fortis, is rediſtilled, and makes what they call a double water, which is near twice as good as that made without it.

VERDOY, in heraldry, denotes a bordure of a coat of arms, charged with any kinds or parts of flowers, fruits, ſeeds, plants, &c.

VERGE, ſignifies the compaſs of the king's court, which bounds the juriſdiction of the lord ſteward of the houſhold; and which is thought to have been twelve miles round.

The term verge is alſo uſed for a ſtick or rod, whereby one is admitted tenant to a copyhold eſtate, by holding it in his hand, and ſwearing fealty to the lord of the manor.

VERGERS, certain officers of the courts of King's Bench and Common Pleas, whoſe buſineſs it is to carry white wands before the judges.

There are alſo vergers of cathedrals and collegiate churches, who carry a rod tipped with ſilver before the biſhop, dean, &c.

VERGETTE, in heraldry, denotes a pallet, or ſmall pale; and hence, a ſhield divided by ſuch pallets, is termed vergette.

VERGILIÆ, in aſtronomy, a conſtellation, the appearance of which denotes the approach of ſpring: it is the ſame with pleiades. See the article PLEIADES.

VERIFICATION, in general, is the act of proving a thing; but among the French, it only ſignifies the recording of the king's edicts by the parliament.

VERJUICE, a juice or liquor drawn from ſour grapes, or wild apples, unfit for wine, or cyder; or from ſweet ones, while yet acid, and unripe.

Its chief uſe is in ſauces, ragouts, &c. though it is alſo an ingredient in ſome medicinal compoſitions; and is uſed by the wax-chandlers to purify their wax.

It has its name from a large ſort of grape, called verjus, or bourdelas, which is ſaid never to grow perfectly ripe; or rather, which in its utmoſt maturity is too auſtere and ſour to be uſed in wine: whence it is commonly turned into verjuice; though in France all unripe grapes are denominated verjus.

There is alſo a tolerable juice made of crabs, gathered, and laid in a heap to ſweat, the ſtalks, &c. ſeparated; they are then ſtamped, or ground, and the crab-maſh put in a hair bag; the juice ſqueezed in a preſs, then barrelled up cloſe, and ſet in a warm place to work for ten or twelve days.

VERMICELLI, or VERMICHELLY, a compoſition of flour, cheeſe, yolks of eggs, ſugar, and ſaffron, reduced to a paſte, and formed into long ſlender pieces like worms, by forcing it with a piſton through a number of little holes.

It was firſt brought from Italy, where it is in great vogue: it is chiefly uſed in ſoups and pottages, to provoke venery, &c.

VERMICULAR, an epithet given to any thing that bears a relation or reſemblance to worms, vermiculi. See WORM.

Anatomiſts particularly apply it to the motion of the inteſtines and certain muſcles of the body.

The vermicular or periſtaltic motion of the inteſtines is performed by the contraction of the fibres thereof, from above downwards; as the antiperiſtaltic motion is by their contraction from below upwards.

VERMIFORMIS, in anatomy, a term applied to various parts in the human body, bearing ſome reſemblance to worms. As ſome muſcles, proceſſes, &c.

Proceſſus or *Apophyſes* VERMIFORMES, two extremities of the cerebellum, ſituate near the fourth ventricle of the brain. See BRAIN.

VERMIFORMES *Muſculi*, are the four muſcles in each hand and foot, which bring the fingers and toes towards the thumbs and great toes, called alſo lumbricales.

VERMILION, a very bright and beautiful colour, in great eſteem among the antients, under the name of minium.

There are two kinds of it, the one natural, the other factitious. The natural is found in ſome ſilver mines, in the form of a ruddy ſand, which is afterwards prepared and purified by ſeveral lotions and coctions. The artificial is made of mineral cinnabar, ground up with aqua-vitæ and urine, and afterwards dried.

It is alſo made of lead burnt and waſhed, or of ceruſs prepared by fire: but this is not properly called vermilion, but minium, or red-lead.

Yet this laſt, however, ſeems to be the real vermilion of the ancients; and both apothecaries and painters ſtill give it the name, to enhance the price.

We have two kinds of vermilion from Holland, the one of a deep red, the other pale; but it is the ſame thing at the bottom: the only difference of colour proceeding from the cinnabar's being more or leſs ground: when the cinnabar is finely ground, the vermilion is pale: and this is preferred before that which is coarſer and redder.

It is of great uſe with painters in oil and miniature; and among the ladies for a fucus, or paint, to heighten the complexion of ſuch as are too pale.

Some diſapprove of vermilion to be uſed in painting prints, unleſs it be prepared by waſhing, as is directed for minium; and then chiefly for dry painting, except it be by thoſe perſons who can uſe it moderately, and with judgment; for all heavy colours will drown the ſhades or ſtrokes of the engraver.

VERMIN, *Vermina*, a collective name including all kinds of little animals, or inſects, which are hurtful or troubleſome to men, beaſts, fruits, &c. as worms, lice, fleas, caterpillars, ants, flies, &c.

VERMINATION, *Verminatio*, the act of breeding worms, and other vermin; particularly bots, in cattle, &c.

VERMINATION is ſometimes alſo uſed among phyſicians, for a ſort of tormina ventris, or wringing of the guts, wherein the patient is affected, as if worms were gnawing his inteſtines.

VERMIVOROUS ANIMALS, are ſuch as feed upon worms.

VERNACULAR, is applied to any thing that is peculiar to ſome one country.

VERNAL, ſomething belonging to the ſpring ſeaſon.

Hence vernal leaves, are thoſe leaves of plants which come up in the ſpring. Vernal ſigns, are thoſe which the ſun is in during the ſpring ſeaſon, viz. Aries, Taurus, and Gemini. Vernal equinox, is that which happens when the ſun is aſcending from the equator towards the north pole.

VERNIER, or NONIUS, among mathematicians, a ſcale of diviſions, ſerving to cut the diviſions of an arch into ſingle minutes.

VERONICA, in botany, a genus of plants, the flower of which has a permanent empalement, cut into five acute ſegments; it has one tubulous petal the length of the empalement; the brim is cut into four oval plain ſegments, which ſpread open, and two ſtamina, which are terminated by oblong ſummits, with a compreſſed germen, ſupporting a ſlender declining ſtyle, crowned by a ſingle ſtigma. The germen afterwards becomes a compreſſed heart-ſhaped capſule with two cells, filled with roundiſh ſeeds.

Mr. Miller has enumerated ſixteen ſpecies of veronica, moſt of which are natives of Europe. Theſe plants may all be propagated by parting their roots, which may be done every year; for if they are not often parted or divided, they will many of them grow too large for the borders of ſmall gardens; but yet they ſhould not be parted into very ſmall heads, becauſe when they have not a number of ſtems, ſo as to form a good bunch, they are ſoon paſt their beauty, and have but a mean appearance. The beſt time to part theſe roots is at Michaelmas, that they may be well rooted again before winter; for when they are removed in the ſpring, they ſeldom flower ſtrong the ſame year, eſpecially if the ſeaſon ſhould prove dry. Thoſe ſorts which grow pretty tall, are very proper to plant on the ſides of open wilderneſs quarters, but thoſe with trailing branches are fit for the ſides of banks or irregular ſhady ſlopes, where they will make an agreeable variety; they are all of them very hardy, ſo are in no danger of ſuffering by cold, and require no other care but to keep them clean from weeds, and to be tranſplanted every ſecond year.

They may alſo be propagated by ſeeds, which ſhould be ſown in autumn, for when they are ſown in the ſpring, the plants rarely come up the ſame year; but, as moſt of the ſorts propagate very faſt by their off-ſets, their ſeeds are ſeldom ſown.

If the plants are placed in a ſhady border, they will thrive much better than when they are more expoſed to the ſun, and their flowers will continue much longer in beauty.

The leaves of veronica have a weak not diſagreeable ſmell, which in drying is diſſipated, and which they give over in diſtillation with water, but without yielding any ſeparable oil. To the taſte they are bitteriſh and roughiſh: an extract made from them by rectified ſpirit is moderately bitter and ſubaſtringent: the watery extract is weaker, though the quantity of both is nearly the ſame; whence ſpirit ſeems to extract their virtue more completely than water. This herb is of great eſteem among the Germans, in diſorders of the breaſt both catarrhous and ulcerous, and for purifying the blood and humours: infuſions of the leaves, which are not unpalatable, are drank as tea, and are found to operate ſenſibly by urine.

VER-PUCERON, in natural hiſtory, a name given to a kind of inſects which are fond of eating the puceron, and deſtroy them in vaſt numbers.

They are thus called, as the ant-eater is formicalis, from their deſtroying great numbers of them.

Theſe ver-pucerons are a ſort of worms produced from the eggs of flies; and are of two principal kinds; the one having legs, the other none.

VER-POLYPE, in natural hiſtory, a name given, by Reaumur and ſome other authors, to a ſpecies of water-worm, by no means to be confounded with the creature called ſimply the polype, and which is ſo famous for its reproduction of parts cut off, and for many other ſingular properties. See POLYPE.

This ver-polype is a ſpecies of water-worm, produced from the egg of a tipula; and had its name given it from ſome remarkable productions, placed at the anterior and poſterior parts of the body, which are ſuppoſed to have ſome analogy with the parts of the ſea-fiſh called the polypus.

Theſe worms are found in muddy ditches, uſually either crawling upon, or buried in the mud. They are of various ſizes, from more than an inch in length to a fifth of an inch, and are ſmooth and even on their ſurface; they are compoſed of ſeveral rings, as other inſects of this kind, and have a brown ſcaly head, of a regular figure, and much harder than the reſt of the body. Juſt below the head, on the under part of the body, there are placed two membranaceous productions which ſeem fragments of arms; they are conſiderably thick, and are cut off obliquely at the ends, and furniſhed with many hairs. At the other extremity of the body there are placed four other productions, reſembling four pieces of cords; two of theſe are affixed to the middle of the lower ſide of the laſt ring but one, and the other two, at the joining of this, to the laſt ring. The anterior pair ſerve the creature greatly in its moving, and theſe hinder ones have their uſe in fixing that part of the body in the earthy caſe the creature ſometimes makes for itſelf, while the head is at liberty to move every-where about in ſearch of prey. Theſe hinder ones are broadeſt at their inſertion, and ſomewhat narrower at the point, and are very flexible and moveable every way.

The anus of the creature is placed near the end of the laſt ring of the body, and is of a ſquare figure; it

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is ſurrounded with a number of rigid hairs or ſpines, and at each corner has a fleſhy tubercle, which ſtands out a conſiderable way from the level of the body; the two under ones are much larger than the other two, and the creature evidently uſes them to puſh itſelf forward in its moving about. Probably, however, theſe parts have ſome other more important uſe. The taking in of air or water is likely enough to be the uſe they are aſſigned for.

The cells which theſe creatures uſually live in, are compoſed principally of fragments of a light and ſpongy earth, and to this they add the broken pieces of ſticks and leaves, and other ſuch ſubſtances as are juſt heavy enough to ſink in water. Mr. Reaumur ſuſpects that they have a method of ſpinning ſome glutinous fluid out of their bowels, to fix theſe things together with. But, though they uſually reſide in theſe caſes, they often quit them, and are found ſwimming about the water, or with their tails at the top, and playing about with their bodies: or at the bottom, crawling on the ſurface of the mud.

When the creature has lived its deſtined time in this ſtate, it changes into a nymph, in the caſe in which it had lived to the time of this change; it throws off the head, and the productions that ſerved as arms, and to faſten it at the bottom of the caſe. Nature has generally made the nymph and cryſalis ſtate of animals a time of reſt and incapacity of motion; but in this, as in the great worms, has given even the nymph a locomotive power, and that a very briſk one. The creature, in this ſtate, had ſufficient need of it, and could never arrive at its laſt change without it. When the time of this final change comes on, the nymph riſes to the ſurface of the water, and, a crack opening on the back, the winged inſect begins to appear. The getting thoroughly out is a work of time; and this is the moſt perilous period of the creature's life; for, if the weather be windy, it is commonly blown into the water, and drowned before the hinder parts are looſe. *Reaumur. Hiſt. Inſ.*

VERSE, *Verſus*, in poetry, a line or part of a diſcourſe, conſiſting of a number of long and ſhort ſyllables, which run with an agreeable cadence, the like being alſo reiterated in the courſe of the piece.

This repetition, according to F. Boſſu, is neceſſary to diſtinguiſh the notion of verſe from that of proſe; for in proſe, as well as verſe, each period and member are parts of diſcourſe, conſiſting of a certain number of long and ſhort ſyllables; only proſe is continually diverſifying its meaſures and cadences, and verſe regularly repeating them. This repetition of the poets appears even in the manner of writing; for one verſe being finiſhed, they return to the beginning of another line, to write the verſe following, and it is to this return, that verſe owes its name.

To make verſe, it is not enough that the meaſures and quantities of ſyllables be obſerved, and ſix juſt feet put one after another in the ſame line. There are further required, certain agreeable cadences, particular tenſes, moods, regimens, and even ſometimes words unknown in proſe. But what is chiefly required, is an elevated, bold, figurative manner of diction; this manner is a thing ſo peculiar to this kind of writing, that without it, the moſt exact arrangements of longs and ſhorts does not conſtitute verſe ſo much as a ſort of meaſured proſe. The Greek and Latin verſes conſiſt of a certain number of feet, diſpoſed in a certain order; and ſome have attempted to make French and Engliſh verſes on the ſame foundation, but without ſucceſs. Voſſius is very ſevere on the modern verſe, and makes it altogether unfit for muſic. Our verſes, ſays he, run all as it were upon one foot, without diſtinction of members or parts, and without regard to the natural quantities of ſyllables. We have no rhythmus at all, and we mind nothing but to have a certain number of ſyllables in a verſe of whatever nature, and in whatever order. Mr. Malcolm vindicates our verſe from this imputation. It is true, ſays he, we do not follow the metrical compoſition of the ancients, yet we have ſuch a mixture of ſtrong and ſoft, long and ſhort, ſyllables, as make our verſes flow ſmooth or rumbling, ſlow or rapid, agreeable to the ſubject. Inſtances of all which we have in the following lines of Pope.

Theſe equal ſyllables alone require,
Tho' oft' the ear the open vowels tire,
While expletives their feeble aid do join,
And ten low words oft' creep in one dull line.
Soft is the ſtrain when Zephyr gently blows,
And the ſmooth ſtream in ſmoother numbers flows;
But when loud billows laſh the ſounding ſhore,
The hoarſe rough verſe ſhould like the torrent roar;
When Ajax ſtrives ſome rock's vaſt weight to throw,
The line too labours, and the words move ſlow.
Not ſo when ſwift Camilla ſcours the plain,
Flies o'er th' unbending corn, and ſkims along the main.

By making a ſmall change or tranſpoſition of a word in any of theſe verſes, any body who has an ear will find, that we make a great matter of the nature and order of the ſyllables. See NUMBERS.

Voſſius adds, that the ancient odes were ſung as to the rhythmus, in the ſame manner as we ſcan them, every pes being a diſtinct bar, or meaſure ſeparated by a diſtinct pauſe, though in reading, that diſtinction was not accurately obſerved. Laſtly, he obſerves, that their odes had a regular return of the ſame kind of verſe, and the ſame quantity of ſyllables, in the ſame place of every verſe; and whereas, in the modern odes, to follow the natural quantity of our ſyllables, every ſtanza would be a diſtinct ſong.

Verſes are of various kinds, ſome denominated from the number of feet, whereof they are compoſed, as the monometer, dimeter, trimeter, tetrameter, pentameter, hexameter, &c.

Some alſo, from the kinds of feet uſed in them, as the pyrrhichion, proceleuſmatic, iambic, trochaic, &c.

Sometimes verſes are denominated from the names of the inventors, or the authors who have uſed them with moſt ſucceſs, as the anacreontic, archilochian, aſclepia, alcaic, ſapphic, &c.

The moderns have invented heroic or alexandrine verſes; the ancients likewiſe invented various kinds of poetical devices in verſe, as centos, echos, &c.

VERSE is alſo uſed for a part of a chapter, ſection, or paragraph, ſubdivided into ſeveral little articles.

The whole bible is divided into chapters, and the chapters are ſubdivided into verſes. The diviſion of verſes in the New Teſtament was firſt made by one Robert Stephens, with which diviſion many learned men find great fault, and yet it is every where followed.

VERSED *Sine of an Arch*, a ſegment of the diameter of a circle, lying between the foot of a right ſine, and the lower extremity of the arch. See the article SINE.

VERSIFICATION, the art or manner of making verſe; alſo the tone and cadence of verſe.

Verſification is properly applied to what the poet does more by labour, art, and rule, than by invention, and the genius or furor poeticus. See the articles POETRY, &c.

VERSION, a tranſlation of ſome book or writing, out of one language into another.

VERT, in heraldry, the term for a green colour. It is called vert in the blazon of the coats of all under the degree of nobles; but in coats of nobility, it is called emerald; and in thoſe of kings, venus. In engraving, it is expreſſed by diagonals, or lines drawn athwart, from right to left, from the dexter chief corner to the ſiniſter baſe.

VERT, or GREEN HUE, in foreſt law, any thing that grows and bears a green leaf within the foreſt, that may cover a deer. This is divided into over-vert, and nether-vert; over-vert is the great woods which in law-books are uſually called hault-bois; nether-vert is the under-woods, otherwiſe called ſub-bois. We ſometimes alſo meet with ſpecial vert, which denotes all trees growing in the king's woods within the foreſt; and thoſe which grow in other men's woods, if they be ſuch trees as bear fruit to feed the deer.

VERTEBRÆ, a chain of little bones reaching from the top of the neck down the back to the os ſacrum, and forming a third part of the human ſkeleton called the ſpina dorſi.

They have their name *à vertendo*, becauſe it is on them the head and trunk turn; the Greeks call them σπονδυλόι, ſpondyli, for the ſame reaſon.

The vertebræ are twenty-four in number; ſeven of them belong to the neck, twelve to the back, and five to the loins, &c.

They lie in a ſtrait line, thoſe of the neck bend inward, and thoſe of the back outwards, for enlarging the cavity of the thorax; and thoſe again of the loins bend inwards, and thoſe of the os ſacrum outward, to enlarge the cavity of the baſon.

In each vertebræ, we diſtinguiſh two parts, the body of the vertebræ, and its proceſſes; the body is ſofter and more ſpongeous than the proceſſes, which are harder and more ſolid. The fore-part of the body is round and convex, the hinder-part ſomewhat concave; its upper and lower ſides are plain, each covered with a cartilage, which is pretty thick forwards, but thin backwards, by which means we bend our body forwards: for the cartilages yield to the preſſure of the bodies of the vertebræ, which in that motion come cloſer to one other. This could not be effected, if the harder bodies of the vertebræ were cloſe to one another. Each vertebræ has three ſorts of proceſſes towards its hinder part, two tranſverſe or lateral, one on each ſide; they are nearer the body of the vertebra than the reſt. In each of them there is a tendon of the vertebral muſcles inſerted. Four oblique proceſſes, two on the upper part, and two on the lower, by theſe vertebræ are articulated to one another; and one acute on the hindermoſt part of the vertebra. Theſe proceſſes, with the hinder or concave part of the body of the vertebræ, form a large hole in each vertebra, and all the holes anſwering one another, make a channel for the deſcent of the ſpinal marrow, which ſends out its nerves to the ſeveral parts of the body by pairs, through two ſmall holes formed by the joining of four notches in the ſides of each ſuperior and inferior vertebra. The vertebræ are articulated to one another by a ginglymus; for the two deſcending oblique proceſſes of each ſuperior vertebra of the neck and back have a little dimple in their extremities, wherein they receive the extremities of the two aſcending oblique proceſſes of the inferior vertebræ; ſo that the two aſcending proceſſes of each vertebra of the neck and back are received, and the two deſcending do receive, except the firſt of the neck, and laſt of the back; but the aſcending proceſſes of each vertebra of the loins receive, and the two deſcending are received contrary to thoſe of the neck and back. The vertebræ are all tied together by a hard membrane made of ſtrong and large fibres: it covers the body of all the vertebræ forwards, reaching from the firſt of the neck to the os ſacrum: there is another membrane which lines the canal, made by the large hole of each vertebra, which alſo ties them all together. Beſides, the bodies of each vertebra are tied to one another by the intervening cartilages; and the tendons of the muſcles, which are inſerted in their proceſſes, tie them together behind. This ſtructure of the ſpine is the very beſt that can be contrived; for had it been all one bone, we could have had no motion in our backs; had it been of two or three bones articulated for motion, the medulla ſpinalis muſt have been neceſſarily bruiſed at every angle or joint: beſides, the whole would not have been ſo pliable for the ſeveral poſtures we have occaſion to put ourſelves in. If it had been made of ſeveral bones without intervening cartilages, we ſhould have had no more uſe of it, than if it had been but one bone. If each vertebra had had its own diſtinct cartilages, it might have been eaſily diſlocated. And, laſtly, the oblique proceſſes of each ſuperior and inferior vertebra keep the middle one, that it can neither be thruſt backwards nor forwards to compreſs the medulla ſpinalis. Thus much of the vertebræ in general; but, becauſe they are not all alike, we ſhall therefore deſcend to a more particular examination. The ſeven vertebræ of the neck differ from the reſt in this, that they are ſmaller and harder. Secondly, that their tranſverſe proceſſes are perforated for the paſſage of the vertebral veſſels. Thirdly, that their acute proceſſes are forked and ſtraight; but, beſides this, the firſt and ſecond have ſomething peculiar to themſelves. The firſt, which is called atlas, is tied to the head, and moves with it upon the ſecond ſemicircularly; its aſcending oblique proceſſes receive the tubercles of the occiput, upon which articulation the head is only moved forwards and backwards; and its deſcending proceſſes receive the aſcending proceſſes of the ſecond vertebra. It has no acute proceſs, that it might not hurt the action of the muſculi recti; but a ſmall tubercle, to which the ſmall ligament of the head is inſerted. In the fore part of its great hole it has a pretty large ſinus, in which lies the tooth-like proceſs of the ſecond vertebra, being faſtened by a ligament that riſes from each ſide of the ſinus, that it compreſs not the medulla ſpinalis. It has two ſmall ſinus's, in its upper part, in which the tenth pair of nerves and the vertebral arteries lie. The ſecond is called epiſtropheus, or vertebra dentata; in the middle between its two oblique aſcending proceſſes, it has a long and round proceſs like a tooth, which is received into the foreſaid ſinus; upon it the head with the firſt vertebra turns half round, as upon an axis. The extremity of this proceſs is knit to the occiput by a ſmall but ſtrong ligament. A luxation of this tooth is mortal, becauſe it compreſſes the medulla ſpinalis. The third vertebra is called axis; and the four following have no name, nor any peculiar difference. The twelve vertebræ of the back differ from the reſt in this, that they are larger than thoſe of the neck, and ſmaller than thoſe of the loins; their acute proceſſes ſlope downwards upon one another: they have in each ſide of their bodies a ſmall dimple, wherein they receive the round extremities of the ribs; and another in their tranſverſe proceſſes, which receives the little tubercle near that extremity of the ribs. The articulation of the twelfth with the firſt of the loins is by arthrodia, for both its aſcending and deſcending oblique proceſſes are received. The five vertebræ of the loins differ from the reſt in this, that they are the broadeſt, and the laſt of them is the largeſt of all the vertebræ. Their acute proceſſes are broader, ſhorter, and wider from one another, their tranſverſe longer, to ſupport the bowels, and the muſcles of the back; they are not perforated as thoſe of the neck, nor have they a dimple or ſinus, as thoſe of the back. The cartilages which are betwixt their bodies are thicker than any of the reſt. The vertebræ of the os ſacrum grow ſo cloſe together in adults, that they make but one large and ſolid bone, of the figure of an iſoſceles triangle, whoſe baſis is tied to the laſt vertebra of the loins, and the upper part of its ſides to the ilia, and its point to the os coccygis. It is concave and ſmooth on its fore-ſide, but convex and unequal on its back-ſide. It hath five holes on each ſide, but the nerves paſs only through the five on its fore-ſide. Its acute proceſſes or ſpines are ſhorter and leſs than thoſe of the loins, and the lower is always ſhorter than the upper. The os coccygis is joined to the extremity of the os ſacrum; it is compoſed of three or four bones, of which the lower is ſtill leſs than the upper till the laſt ends in a ſmall cartilage: it reſembles a little tail turned inwards: its uſe is to ſuſtain the ſtraight gut; it yields to the preſſure of the fœtus in women in travail, and midwives uſe to thruſt it backwards, but ſometimes rudely and violently, which is the occaſion of great pain, and of ſeveral bad effects. From what has been ſaid, it is eaſy to underſtand how the motion of the back is performed: though each particular vertebra has but a very ſmall motion, yet the motion of all is very conſiderable. We have ſaid, that the head moves only backwards and forwards upon the firſt vertebra, and ſemicircularly upon the ſecond. The ſmall protuberance which we have remarked in the bone of the hind head, falling upon another in the firſt vertebra, ſtops the motion of the head backwards, that it compreſs not the ſpinal marrow; and, when the chin touches the ſternum, it can move no farther forwards. The oblique or ſemi-circular motions are limited by the ligament which ties the proceſs of the ſecond vertebra to the head, and by thoſe which tie the firſt to the ſecond vertebra. The motion of the other ver-

vertebræ of the neck is not ſo manifeſt; yet it is greater than that of the vertebræ of the back, becauſe their acute proceſſes are ſhort and ſtraight, and the cartilages which are between their bodies thicker. The twelve vertebræ of the back have the leaſt motion of any, becauſe their cartilages are thin, their acute proceſſes are long, and very near to one another; and they are fixed to the ribs, which neither move forwards nor backwards. But the greateſt motion of the back is performed by the vertebræ of the loins, becauſe their cartilages are thicker, and their acute proceſſes are at a greater diſtance from one another; for, the thicker the cartilages are, the more we may bend our body forwards; and, the greater diſtance there is betwixt the acute proceſſes, the more we may bend ourſelves backwards. This is the ſtructure and motion of the vertebræ, when they are in their natural poſition; but we find them alſo in ſeveral perſons ſeveral ways diſtorted. If the vertebræ of the back ſtick out, ſuch as have this deformity are ſaid to be bunch-backed; and in ſuch the cartilages which are between the vertebræ are very thin and hard forwards, but conſiderably thick backwards, where the oblique proceſſes of the ſuperior and inferior vertebræ are at a conſiderable diſtance from one another, which diſtance fills up with a viſcous ſubſtance. This inequality of the thickneſs of the cartilages happens either by a relaxation or weakneſs of the ligaments and muſcles, which are faſtened to the back-ſide of the vertebræ: in which caſe their antagoniſts, finding no oppoſition, remain in a continual contraction, and conſequently there can be no motion in theſe vertebræ. If this deformity has been from the womb, then, the bones being at that time ſoft and tender, the bodies of the vertebræ partake of the ſame inequality as the cartilages. If the bunch be towards one ſhoulder, for example, towards the right, then the cartilages on that ſide are very thick, but thin and dry on the other ſide; on the left ſide the oblique apophyſes come cloſe together, but on the right there is a conſiderable diſtance between them; and the ligaments and muſcles are greatly extended on the right ſide, but thoſe on the left are much contracted. If the vertebræ are diſtorted inwards, all things have a different face; the cartilages, and ſometimes the vertebræ, are very thick forwards, but very thin and hard backwards; the acute and oblique proceſſes are very cloſe to one another, and the ligaments upon the body of the vertebræ are greatly relaxed, but the muſcles and ligaments which tie the proceſſes together are very much contracted. Theſe diſtortions ſeldom happen in the vertebræ of the loins; but ſuch as are ſo miſerable have little or no motion of their back.

VERTEBRALES, in anatomy, a pair of muſcles, whoſe office is to ſtretch out all the vertebræ of the neck.

VERTEX, in anatomy, denotes the crown of the head, or the uppermoſt part, ſituated between the ſinciput and the occiput.

Hence vertex is alſo uſed, figuratively, for the top of other things: thus the vertex of a cone, pyramid, &c. is the top of any one of theſe figures. See the article CONE, &c.

VERTEX *of a Glaſs*, in optics, the ſame with the pole thereof.

VERTEX, in aſtronomy, is alſo uſed for the point of heaven perpendicularly over our heads, properly called the zenith. See ZENITH.

Path of the VERTEX, the circle deſcribed by the vertical point during one revolution of the earth about its axis.

VERTICAL CIRCLE, in aſtronomy, a great circle of the ſphere, paſſing through the zenith and nadir, and cutting the horizon at right angles: it is otherwiſe called azimuth. See AZIMUTH.

Prime VERTICAL, is that vertical circle or azimuth which paſſes through the poles of the meridian; or which is perpendicular to the meridian, and paſſes through the equinoxial points.

VERTICAL *of the Sun*, is the vertical which paſſes through the center of the ſun at any moment of time.

VERTICAL PLANE. in perſpective, is a plane perpendicular to the geometrical plane, paſſing through the eye, and cutting the perſpective plane at right-angles.

VERTICAL PLANE, in conics, is a plane paſſing thro' the vertex of the cone, and parallel to any conic ſection. See PLANE.

VERTICAL LINE, in conics, is a right line drawn on the vertical plane, and paſſing through the vertex of the cones.

VERTICAL DIAL, is a ſun-dial drawn on the plane of a vertical circle, or perpendicular to the horizon.

VERTICAL POINT, in aſtronomy, the ſame with vertex or zenith.

VERTICILLATE PLANTS, are ſuch as produce their flowers round the joints of the ſtalks in whorles; theſe are the ſame with the labiated or lipped flowers. All the plants producing flowers in this manner, belong to the didynamia claſs of Linnæus's ſyſtem, and of the order gymnoſpermia; ſuch are hyſſop, mint, thyme, &c.

VERTICITY, is that property of the load-ſtone, whereby it turns, or directs itſelf to ſome peculiar point. See MAGNET.

VERTIGO, in medicine, a diſeaſe in which the head ſeems to turn round.

This, according to Dr. Willis, is a diſorder in which viſible objects ſeem continually to turn round, whilſt the patients are affected with a perturbation or confuſion of the animal ſpirits in the brain, which hinders their influx into the nerves. Hence it is, that the viſive and locomotive faculties often fail to ſuch a degree, that the patient is ready to drop down, and complains of darkneſs. Etmuller divides it into three kinds; the firſt of which is a ſimple vertigo, in which there is only a tranſient and ſhort continued gyration of objects. The ſecond is a dark vertigo, or ſcotomia, when the eyes are darkened, or ſo affected, as if ſeveral colours were before them. The third is the vertigo caduca, in which the patient preſently falls down.

A vertigo may be produced by every cauſe which can diſtend, preſs, or contract the arteries; ſuch as ſudden fear, ſurprize, ebriety, and voracity, by which the regular influx and reflux of the animal ſpirits into the optic nerves and retina are prevented. Sometimes, alſo, it may be produced by an acid, or any peccant humour, lodged in the ſtomach, and vellicating its nerves, which communicate with the retina; for which reaſon the hypochondriac and hyſteric paſſions may produce a vertigo.

With reſpect to the cure, the regimen in general, ought to be the ſame with that in the apoplexy or epilepſy. If the patient is plethoric, a due quantity of blood is to be taken away; and if a nauſea, loſs of appetite, or any other diſorder of the ſtomach remain, an emetic is to be preſcribed; then cathartics and ſpecifics are to be ordered. According to Mayerne, calamus aromaticus, in whatever form, is good for a vertigo, and eſteemed a ſecret for that diſorder. The ſame author informs us, that a German phyſician cured a great many of vertigoes, by pills made of ſugar of lead and cypreſs-turpentine; four or five grains of which were to be taken for a doſe, and their uſe perſiſted in for ſome days. Gliſſon, as Bates informs us, after all other medicines had failed, was cured of a ſevere vertigo, of three weeks continuance, by ſhaving his head, and applying to it a plaſter of the flowers of ſulphur and whites of eggs. Some order a cauſtic, or ſeton, to be applied to the back part of the neck; a cautery to the bregma, and Bates's epileptic electuary, or Fuller's Peruvian epileptic electuary, to be uſed internally.

Willis informs us, that after he had in vain tried all other medicines, he, with ſucceſs, preſcribed the following powder: take of the powder of the roots of male piony, two ounces; of the flowers of male piony, one ounce; of peacock's dung, of the whiteſt kind, half a pound; and of white ſugar, two ounces: reduce to a powder, the doſe of which is to be about the quantity of a ſpoonful twice a day, drinking after it a draught of a decoction of ſage and roſemary, impregnated with coffee.

Heiſter orders camphorated ſpirit of wine alone, or mixed with ſpirit of hartſhorn, to be applied to the top of the head and temples. And when the diſorder proceeds from crudities in the ſtomach, he adviſes to prepare and diſſolve them by neutral ſalts, that they may be afterwards evacuated by an emetic, or purge. After this, the patient ſhould uſe ſtomachics and cephalics; as alſo a moderate quantity of wine at meals, which ſhould be ſparing. Pyrmont-water is alſo ſaid to be excellent in this caſe.

VERU-MONTANUM, in anatomy, a kind of little valve, in the place wherein the ejaculatory ducts enter the urethra.

Its uſe is to prevent the urine, in paſſing the urethra, from getting in at theſe ducts, and ſo mixing with the ſemen.

VERY LORD and VERY TENANT, are thoſe that are immediate lord and tenant to one another.

VESICA, in anatomy, a bladder, a membranous or ſkinny part in which any humour is contained. See BLADDER.

VESICATORY, *Veſicatorium*, an external medicine, ſerving to raiſe a bliſter; whence, alſo, it is itſelf, tho' improperly, called a bliſter.

Veſicatories are unguents, cataplaſms, or plaſters, made of ſharp irritating medicines, which have a faculty of drawing the humours from within, outwards, inflaming and ulcerating the ſkin, and raiſing veſicæ, or bladders, whence their denomination veſicatory.

We have veſicatories made of cantharides, euphorbium, figs, ſublimate of mercury, lapis infernalis, muſtard, anacardium, ſquills, briony, vinegar, pepper, leaven, which are incorporated and made up with honey, gums, reſins, &c. to bring them to the conſiſtence required.

VESICULA, VESICLE, a diminutive of *veſica*; ſignifying a little bladder.

The lungs conſiſt of veſiculæ. or lobules of veſiculæ, admitting air from the bronchiæ; and not only air, but alſo duſt, &c.

There are ſeveral parts in the body which bear this appellation; as,

VESICULA *Fellis*, *ciſtula fellis*, or the gall bladder; which is an oblong membranous veſſel, not unlike a pear both in form and ſize; and is ſituated in the hollow part of the liver.

It adheres to the liver, not only by its veſſels, which it receives from it, but likewiſe by its membranes, of which, the external is common to both. The lower part, which hangs out of the liver, reſts on the pylorus of the ſtomach.

Its trunks, or membranes, are uſually reckoned five; an outer, or common one, from the peritonæum; an inner one, on that ſide which adheres to the liver from the capſula of the porta, and of the porus bilarius. And three proper ones: the firſt of which is vaſculous; the ſecond, muſcular; and third, glandulous.

But Dr. Drake, viewing a piece of dried gall-bladder with a microſcope, found but little reaſon for this accurate diſtinction; the ſeveral orders of fibres of the ſeveral coats, appearing to be no other than an infinite perplexity of veſſels diverſly ramified.

The gall-bladder is uſually diſtinguiſhed into the fundus, which is the wideſt part; and collum, or neck, which is the narroweſt.

The neck of the veſicula fellis being prolonged, terminates in a duct, called meatus cyſticus, or bilarius; which, at about two inches diſtance from the gall bladder, is joined to the meatus hepaticus; theſe, together, form the ductus communis.

The uſe of the gall-bladder, is to receive the bile, after its being ſecreted in the glands of the liver; and to diſcharge it by the common duct into the duodenum.

The bile found in this veſſel is of a brighter yellow, a greater conſiſtence, and is alſo more bitter and acrimonious than that in the porus bilarius.

VESPA, the waſp, in zoology. See the article WASP.

VESPER, or HESPER, in aſtronomy. See the article HESPER.

VESPERS, in the church of Rome, denote the afternoon ſervice, anſwering, in ſome meaſure, to the evening prayers of the church of England.

Sicilian VESPERS, is a famous æra in the French hiſtory, ſignifying a general maſſacre of all the French in Sicily, in the year 1282; to which the firſt toll that called to veſpers was the ſignal.

Some will have it to have happened on Eaſter-eve: others, on the day of the Annunciation. It was raiſed by one Prochites, a cordelier, at the time when Charles of Anjou, count of Provence, was king of Naples and Sicily: —The women with child by French-men were not ſpared.

After the like manner, we ſay, the Mattins of Moſcow, ſpeaking of the Muſcovites aſſaſſinating their prince Demetrius, and all the Poles, his adherents, at Moſcow, the twenty-ſeventh of May, 1600, under the conduct of their duke Choutſky, at ſix o'clock in the morning.

VESPERTILIO, the bat, in zoology, a genus of quadrupeds of the order of the feræ, the characters of which are theſe: the fore-teeth in the upper jaw are ſix in number, acute, and diſtant from each other; the fore-teeth of the lower jaw are alſo ſix, and acute, but contiguous: the canine teeth are two both above and below, on each ſide: the feet have each five toes; and the fore-feet have the toes connected by a membrane, and expanded into a ſort of wings, whereby it flies; whence this animal has been generally, but with the utmoſt impropriety, ranged among the birds.

The common bat is about the bigneſs of a mouſe, and very much reſembles it in ſhape and colour. There are ſeveral other ſpecies of this creature, ſome with, and others without, a tail.

VESPERTILIONUM ALÆ, bats-wings, in anatomy, a name given to the two broad ligaments which connect the bottom of the uterus to the bones of the ilium. See the article UTERUS.

VESSEL, *Vas*, denotes in general any thing for holding liquors; ſuch are our domeſtic cups, pots, &c. as alſo the retorts, matraſſes, crucibles, &c. of the chemiſts. See CHEMICAL *Laboratory*.

In anatomy, all the parts which contain or convey a fluid, are called veſſels; as the veins, arteries, lymphatics, &c. See VEIN, ARTERY, &c.

Some alſo extend the word veſſel to the nerves, as ſuppoſing them the conduits of the animal ſpirits. See NERVES, and ANIMAL SPIRITS.

VESSEL, in navigation, a general name for all ſorts of ſhips. See the article SHIP.

VESTALIA, in Roman antiquity, a feſtival celebrated in honour of the goddeſs Veſta, on the fifth of the ides of June; that is, on the ninth of that month.

On that day, banquets were made before the houſes; and meats were ſent to the veſtals, to be offered by them to the goddeſs.

The aſſes that turned the mills for grinding corn, were, on this occaſion, led about the city, crowned with flowers, and chaplets formed of pieces of bread; and the mill-ſtones were likewiſe decked with garlands and crowns.

The veſtalia had their names from that of their goddeſs Veſta, from the Greeks called ἑστία, fire, or hearth; whence Cicero derives the Latin name. Accordingly, the poets frequently uſe Veſta, for fire, or flame; as they do Jupiter for air, Ceres for corn, &c.

VESTALS, in church hiſtory, prieſteſſes of the goddeſs Veſta.

The inſtitution of this religious order is aſcribed to king Numa, who, having built a temple to Veſta, in which a perpetual fire was to be kept up, committed the care of ſupplying and preſerving it to four veſtals, whoſe names were Gegania, Verenia, Canuleia, and Tarpeia. Afterwards Tarquin the elder added two more to them; and it does not appear, that their number ever exceeded ſix, among whom one was ſuperior to the reſt, and called *Veſtalis maxima*.

The veſtals were choſen from ſix to ten years of age, beyond which age none was admitted among them. They were obliged to ſtrict continence for thirty years,

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the ten firſt of which were employed in learning the ceremonies of religion, the next ten in the performance of them, and the ten laſt in teaching them to the younger veſtals. After this, they were permitted to lay aſide their ornaments, quit their office as prieſteſſes, and marry. But, as theſe marriages were obſerved not to be very happy, few of them left their old profeſſion, even after the time of their miniſtry was expired. And they found themſelves well compenſated for the reſtraints of their condition, by the honours that were annexed to it. When they appeared in public, they were attended by Lictors, as the kings and conſuls were. If they accidentally met a criminal going to execution, he was immediately pardoned. They had the precedence whereever they came, and ſeats of diſtinction provided for them at the ſhews of the Circus. Nay, at laſt, they had a right of being carried to the Temple of Jupiter in a chariot, which was an honour paid only to thoſe of the imperial family; and they were buried within the city, which was a privilege allowed to none but the greateſt perſonages of the empire.

But, as the honours done them were great, ſo their faults were not ſuffered to go unpuniſhed. The leaſt levity in them, or the ſmalleſt neglect in their office was tried by the Pontifices, and at their command puniſhed with ſeverity. That puniſhment eſpecially, which was inflicted on them for proſtituting their honour, had ſomething in it inexpreſſibly terrible. The criminal was ſentenced to death. On the day of execution, the pontifex maximus ſtripped her of her ornaments, and ſhe was cloathed in a mourning habit. She was carried in a litter, ſwathed ſo tight as to be deprived of the uſe of her voice. Her friends and relations walked before her in tears; and the proceſſion paſſed croſs the Forum, and thence through the Porta Collina, to the place of her puniſhment. A little vault was dug in the earth, with a lamp burning in it. The veſtal was let down into this vault, the entrance of which was bricked up, and covered with earth. And here ſhe was left buried alive.

To ſuffer the ſacred fire to go out, was an unpardonable neglect. It was a law, *Virgines veſtales in urbe cuſtodiunto ignem foci publici ſempiternum.* And Feſtus tells us, that when a veſtal ſuffered it to go out, ſhe was puniſhed with whipping, and treated as a ſlave. The whole city was in a conſternation at the accident, and a freſh fire was kindled in the temple of Veſta, with many purifications. This new fire was kindled either by rubbing two pieces of wood one againſt the other, or by means of a burning-glaſs, which collecting the pure rays of the ſun upon ſome combuſtible matter, ſet it in a flame.

The habit of the veſtal virgins conſiſted of an headdreſs, called infula, which ſat cloſe to their heads, and from whence hung certain laces called vittæ; a kind of ſurplice made of white linen, and over it a purple mantle with a long train to it.

VESTIBLE, *Veſtibulum*, in architecture, a kind of entrance into a large building; being an open place before the hall, or at the bottom of the ſtair-caſe. Veſtibles, intended for magnificence, are uſually between the court and the garden.

The Romans had veſtibles at the entrance of their houſes, for ſheltering thoſe perſons who were obliged to ſtand at the door; and we have now veſtibles of a like kind in many old churches, houſes, &c. uſually called porches.

The term veſtible is ſometimes alſo uſed for a little anti-chamber, before the entrance of an ordinary apartment.

VESTIBLE *of the Ear*, in anatomy, a cavity forming the middle part of the labyrinth of the ear.

VESTIGIA, a Latin term frequently uſed, by Engliſh writers, for the traces or footſteps which any thing has left behind it.

VESTRY, a place adjoining to a church, where the veſtments of the miniſter are kept; and alſo a meeting at ſuch place, conſiſting of the miniſter, church-wardens, and chief men of moſt pariſhes, who make a pariſh veſtry or meeting. By cuſtom there are ſelect veſtries, being a certain number of perſons choſen to have the government of the pariſh, make rates, and take the accounts of church-wardens, &c. And it is here to be obſerved, that when any rates are made, the pariſhioners muſt have notice of a veſtry held for that purpoſe; in which caſe all that are abſent ſhall be included by a majority of the pariſhioners preſent, who in conſtruction of law are the whole pariſh. Veſtries of pariſhes are to be conſulted by pariſh-officers; and if a pariſhioner, who has a right to be preſent and vote at a veſtry, be ſhut out of the veſtry-room, action of the caſe lies.

VESTRY-MEN, a ſelect number of the principal perſons of every pariſh within the city of London, and elſewhere; who yearly chooſe pariſh-officers, and take care of its concernments.

They are thus called, becauſe they uſually meet in the veſtry of the church.

VESTRY-CLERK, an officer who keeps the pariſh accounts.

VETCH, *Viciæ*, in botany, a genus of plants, the flower of which is of the butterfly kind; the ſtandard is oval, broad at the tail, indented at the point, and the borders are reflexed; the two wings are ſhorter than the ſtandard; the keel is ſhorter than the wings; the tail is oblong. It has ten ſtamina, nine joined and one ſeparated, terminated by erect ſummits, and a linear compreſſed germen, ſupporting a ſlender ſtyle, crowned by an obtuſe ſtigma, which is bearded on the under ſide. The germen afterwards turns to a long pod with one cell opening with two valves, ending with an acute point, containing ſeveral roundiſh ſeeds.

Mr. Miller has enumerated five ſorts of vetches, and alſo ſays there are many more ſpecies of this genus, ſome of which grow naturally in England; but as they are rarely cultivated, except in botanic gardens for the ſake of variety, they are omitted, as they are plants of little uſe or beauty.

Some ſorts of this plant, the ſeeds of which ripen in autumn, grow naturally in moſt parts of England, in ſhady places among buſhes, and by the ſides of woods. The roots of theſe are perennial; but their ſtalks are annual, weak, and grow to ſo great a length (for they will climb up to the height of ſix or eight feet wherever the tendrils which proceed from the end of their leaves can lay hold of boughs, branches, or the ſide of a hedge, to ſupport them,) that they are hardly fit to be cultivated in the field, though ſome writers have recommended them for this purpoſe; for as they cannot be ſupported there, they will trail ſo much upon the ground, that they will be apt to rot: nor do their ſhoots, which are leſs ſucculent than thoſe of the vetch commonly raiſed, grow to a ſufficient height to be cut for uſe till late in the ſpring, when there is little want of green food for cattle.

Mr. Miller, after ſowing for many years the common vetch or tare, which is much cultivated in the fields for fodder, ſeems to think that which has black ſeeds, a diſtinct ſpecies from the white: for he has never found either of them vary. Both theſe are annual, and periſh ſoon after they have perfected their ſeed. Their ſtalks are angular, ſtreaked and hairy: they are weak, and want ſupport, and generally trail upon the ground when they do not find any thing to faſten themſelves to. Their leaves are compoſed of ſeveral pair of blunt lobes, and are terminated by tendrils. The flowers, which are pretty large, proceed from the wings of the ſtalk, and ſit very cloſe to the baſe of the foot-ſtalks of the leaves. Two of theſe flowers generally ſpring from the ſame joint: thoſe of the black ſeeded ſort are purple, and thoſe of the white ſeeded are white. They appear in June and July, and are ſucceeded by erect pods containing three or four round ſeeds in each, which ripen in Auguſt and September.

The white vetch is rather the more ſucculent plant of the two, and therefore it is beſt for fodder: but many are unwilling to cultivate this ſort, becauſe their ſeeds, being white, are much ſooner diſcovered by rooks and other birds, than thoſe of the black, which bear a nearer reſemblance to the colour of the ground. This objection may, however, be eaſily removed, by ſowing them in drills, and then covering them carefully, inſtead of the uſual method of ſcattering them with a broad-caſt, and plowing them in lightly.

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The ſmall black-ſeeded vetch, which ſome call rathripe, and others pebble, goar, or ſummer vetch, is much tenderer than either of the former, and therefore leſs cultivated. This muſt always be ſown in the ſpring: whereas the others may be ſown in ſpring or autumn.

But another ſpecies of vetch, viz. the Siberian, hardly known to the generality of farmers in this country, bids fair to become, perhaps, the moſt uſeful of all for fodder; for its ſtalks grow to a great length, and are well furniſhed with leaves, which do not decay in autumn, like thoſe of the other ſorts, but continue green all the winter, in defiance of the hardeſt froſt: ſo that in February and March, when there often is a ſcarcity of green fodder for ewes and lambs, this may be of ſingular ſervice, eſpecially if theſe plants are ſupported from trailing upon the ground. Their flowers, which appear in July, are of a light blue colour.

This, like our common vetch, may be ſown in the ſpring, or in autumn; and when the plants are come up, they will not require any other culture than keeping them clear from weeds; a work which, if the ſeeds are ſown thin in rows four feet aſunder, as Mr. Miller rightly adviſes, may be eaſily done with the Dutch hoe, while they are young, and afterwards with the hoeing plough. By this thin ſowing, the ſtalks of theſe vetches, which ſend out many branches, and extend very far, will be kept from matting ſo cloſely together as to rot each other by excluding the air; and by earthing up their ſtems in the ſame manner as ſhould be done for peas and beans, they will be greatly ſtrengthened, their leaves will grow the larger and more ſucculent, and they will conſequently yield an increaſed quantity of fodder. The repeating of this as often as it may be found neceſſary to deſtroy the weeds in ſummer, which may be done at a very ſmall expence, and is particularly proper when the growth is intended for the green food of cattle, will be attended with the farther important advantage of preparing the ground thoroughly for whatever other crop may afterwards be put upon it.

As the plants of this kind of vetch will not be in danger of being hurt by froſt, they ſhould not be cut till the ſpring, when the beſt way will be to take them as they may be wanted, green, for the feeding of ewes: but ſome of them ſhould be left untouched, for ſeeds; for if thoſe which are cut do ſhoot out again, they will flower ſo late in ſummer, that their ſeeds will not ripen, unleſs the autumn proves very warm. A better way will therefore be to ſow a proper quantity of ſeeds for this purpoſe in a ſeparate ſpot of ground: becauſe, when the other is cut, the ground may be plowed for other crops; and if the ſeaſons ſhould be ſo mild as to produce a ſufficiency of green food independent of this, the vetches may be plowed into the ground, to which they will be an excellent dreſſing for other crops.

Mr. Miller, who has a high opinion of this ſort of vetch, and whoſe recommendation of it ought to have very great weight, is now beginning to try it in the field, where he has not yet had experience of its culture: but the experiments which he has made with it for ſix years paſt, on ſmall patches of it ſown in gardens, in different ſituations, have fully anſwered his expectation: for he has found theſe plants continue in great verdure in all thoſe places, when moſt of the perennial plants in the ſame ſituation have ſuffered greatly by the froſt, and could have cut from only eight of them as much fodder as would have been equivalent to half a truſs of clover.

Vetches are generally ſown either in autumn, or early in the ſpring: but the beſt time, in this country, is toward the beginning of Auguſt; becauſe the rains which uſually fall about that ſeaſon will bring them up in a ſhort time, and the plants will get ſtrength before winter, and be fit to cut for the food of cattle early in the ſpring, when green fodder is moſt wanted: and if they are deſigned for ſeed only, theſe early ſown vetches will come early into flower, and their ſeeds will ripen early, ſo that they may be cut and ſtacked in good weather, which is a great advantage; for thoſe which ripen late, are often ſtacked or houſed wet, and then their ſeeds frequently ſprout in the mow, and are ſpoiled.

Vetches will do well in almoſt any ground; not excepting even ſuch as can ſcarcely produce any other plant. The common method of ſowing them is in broadcaſt, ploughing them lightly in, as was obſerved before; and the uſual allowance is two buſhels of ſeed for an acre of land, tho' ſome ſow two buſhels and an half. Either of theſe practices may do well enough for thoſe vetches which are intended to be cut for fodder in the ſpring; but when they are ſown with a deſign to let them ſtand for ſeed, it will certainly be much better to ſow them in drills, in the ſame manner as is practiſed for peas; and in this caſe leſs than half of the abovementioned quantity of ſeed will be ſufficient: for the rows ſhould be at leaſt three feet aſunder, that the hoe-plough may have room to go between them, to deſtroy the weeds, and earth up the plants, which, when thus managed, will produce a much greater crop, and ripen better and earlier, than in the common way. Theſe drills ſhould be of about the ſame depth as for peas, and the ſeeds ſhould be ſcattered at about the ſame diſtance in the drills, in which they ſhould be carefully covered over as ſoon as they are ſown; for otherwiſe the rooks will diſcover them; and when thoſe voracious creatures once find the rows, they will ſpeedily deſtroy them intirely, if they are not carefully watched. The preventing of this is another advantage which attends the ſowing of vetches early in autumn, rather than in the ſpring: becauſe there is more food for rooks and pigeons in the open field in the former of theſe ſeaſons, and the plants will then appear much ſooner above ground. Toward the end of October, by which time the plants will have acquired conſiderable ſtrength, the horſe-hoe ſhould begin to work between the rows, provided the weather be dry: and in doing this, particular care ſhould be taken to lay the earth up as high to the ſtems of the plants as can poſſibly be, without covering their tops. This will help to ſecure them againſt froſt, and clear the ground of weeds at leaſt till March, when the plants ſhould be earthed up a ſecond time, and the intermediate ſpaces between their rows be cleaned again, in the ſame manner as before. This will make them grow ſo vigorouſly, that they will meet and cover thoſe ſpaces in a little time: whereas thoſe ſown in the ſpring will not grow to half this ſize, and will be very late in flowering.

When vetches are intended only for fodder, of which they generally afford two good crops in the year, in hot countries, or when the farmer deſigns them for plowing in, by way of manure, they need not be ſown in drills, or huſbanded in the manner directed: the common broad-caſt way will then do well enough: but ſtill it is moſt adviſeable, in either caſe, to ſow them early in autumn; becauſe, in the firſt place, they will produce the deſired green fodder much earlier in the ſpring; and in the ſecond, they will be fit to plow in much ſooner the following year, and thereby have time properly to meliorate the land, and prepare it to receive the enſuing crop, which they are generally allowed to do even more effectually than peas. Stiff clays are peculiarly benefited by this dreſſing: but it ſurely is bad huſbandry to ſow vetches for green fodder, where lucerne will thrive; becauſe this laſt will yield greater plenty of ſtill more nouriſhing food.

In ſome countries, eſpecially abroad, they mix oats with their tares or vetches, an equal quantity of each, and ſow them in February. The vetch, ſupported in ſome meaſure by the oat, grows the higher for it: and, about the middle of May, this mixture is mowed, and given to horſes and other cattle, which it fattens greatly. Mr. Mortimer likewiſe thinks it a good way to ſow horſe-beans and tares together: their ſeeds are eaſily parted with a riddle: and another obſervation in which he agrees with the Maiſons Ruſtiques, is, that more vetches ſhould not be ſown at any one time, than can be covered the ſame day, becauſe the dew is apt to ſpoil them: conſequently they ſhould not be ſown till two or three hours after the riſing of the ſun; by which time the moiſture will be exhaled from off the ſurface of the earth. But though their ſeeds cannot bear dampneſs, which would ſoon rot them, their plants, eſpecially in ſandy land, often periſh in dry years, for want of water. To make

them flouriſh well, they require a ſhower of rain every ten or twelve days. One plowing to turn in the ſtubble of the preceding crop, and another at the time of ſowing, are ſufficient for this plant: but thoſe who give only one plowing, which is when they ſow, and afterwards harrow in the ſeed, neither have, nor can expect, an equally good return.

When vetches are cultivated for their ſeeds, they ſhould be cut ſoon after the pods turn brown, and ſtacked as ſoon as they are dry: for if they are ſuffered to lie out in the field, till they receive wet, and there then comes a hot day, moſt of the pods will burſt, unleſs they happen to have been blighted; in which caſe they will not open ſo eaſily. Their haulm, when dry, and threſhed, is eſteemed good food for cattle, and ſome ſay that their ſeeds are as good for horſes, as beans; which, if true, ſhould render them the more valuable, becauſe theſe will grow on the lighteſt ſandy land, where beans will not thrive; and may therefore, as Mr. Miller obſerves, be a good improvement to ſome counties in England where they do not even attempt to cultivate the bean. About three loads from an acre are reckoned a good crop.

Vetches, when threſhed out, will be as good for ſowing at the end of five or ſix years, as at firſt, if care be taken to turn them in a heap from time to time. Mr. Mortimer cautions the huſbandman to lay them by themſelves in ſome convenient place, ſeparate from his other corn, becauſe they will otherwiſe be apt to foul it.

It is commonly ſaid, that the farmer cannot ſow any thing more profitable than vetches; for that, beſides enriching the land, a load of them will go farther than two loads of hay: but Mr. Liſle has a calculation tending to prove, that an acre of broad clover is worth twenty ſhillings a year more than an acre of any vetches, and that the clover ſhould therefore be preferred, wherever the ground will bear it well.

VETERAN, in the Roman militia, a ſoldier who was grown old in the ſervice; or who had made a certain number of campaigns; and on that account was entitled to certain benefits and privileges.

Twenty years ſervice were ſufficient to entitle a man to the benefits of a veteran. Theſe privileges conſiſted in being abſolved from the military oath; in being exempted from all the functions of a ſoldier; and in enjoying a certain ſalary, or appointment, &c.

In France, the term veteran is ſtill retained to ſuch officers as have held their poſts 20 years; and who enjoy certain of the honours and privileges affixed thereto, even after they have laid them down.

A veteran counſellor has a voice and ſeat at audiences, tho' not at proceſſes by writing. A veteran ſecretary of the king acquires the privileges, &c. of nobility, to himſelf and his children.

VIA-LACTEA, in aſtronomy, the milky-way, or galaxy. See GALAXY.

VIA-SOLIS, *the Sun's Way*, in aſtronomy, is uſed, among ſome aſtronomers, for the ecliptic line, ſo called, becauſe the ſun never goes out of it. See the article ECLIPTIC.

VIÆ PRIMÆ, firſt paſſages, among phyſicians, are the œſophagus, ſtomach, and guts; including the whole length of the alimentary duct, or canal, from the mouth to the ſphincter ani.

VIALES, in mythology, a name given among the Romans to the gods who had the care and guard of the road and highways.

The dii viales, according to Labeo, were of the number of thoſe gods called dii animales, who were ſuppoſed to be the ſouls of men changed into gods; and were of two kinds, viz. the viales and penates.

VIATICUM, in the church of Rome, an appellation given to the euchariſt, when adminiſtered to perſons at the point of death.

VIATOR, in antiquity, an officer of juſtice among the Romans.

The term, originally, had no other ſignification than that of a public meſſenger, or ſervant, ſent to advertiſe the ſenators and magiſtrates when aſſemblies were to be held, where their preſence was required.

Hence, becauſe, in the firſt ages of that empire, the Roman magiſtrates lived moſtly at their country-houſes; theſe officers being obliged to be frequently upon the road, were called *viatores*, travellers; from *via*, highway.

In proceſs of time, the name viator became common to all officers of the magiſtrates, lictors, accenſi, ſcribes, ſtatores, and cryers; either by reaſon theſe names and offices were confounded in one: or becauſe viator was a general name, and the reſt particular ones, ſpecifying the particular functions they diſcharged, as A. Gellius ſeems to inſinuate, when he ſays, that member of the company of viatores, who binds a criminal condemned to be whipped, was called lictor.

Be this as it will, the names lictor and viator are often uſed indiſcriminately for each other; and we as often meet with "Sent to ſeek, or advertiſe him by a lictor, as by a viator."

None but the conſuls, prætors, tribunes, and ædiles, had a right to have viatores.—They were not to be Roman citizens, and yet they were required to be free.

VIBEX, is ſometimes uſed, by phyſicians, for a black and blue ſpot in the ſkin, occaſioned by an afflux or extravaſation of blood.

VIBRATION, in mechanics, a regular, reciprocal motion of a body, as a pendulum, &c. which, being freely ſuſpended, ſwings or oſcillates, firſt this way, then that. See PENDULUM.

VIBRATION is alſo uſed in phyſics, &c. and for divers other regular alternate motions.—Senſation is ſuppoſed to be performed, by means of the vibratory motion of the nerves, begun by external objects, and propagated to the brain.

The ſeveral ſorts and rays of light, Sir Iſaac Newton conceives to make vibrations of ſeveral bigneſſes; which according to thoſe magnitudes, excite ſenſations of ſeveral colours; much after the ſame manner as vibrations of air, according to their ſeveral magnitudes, excite ſenſations of ſeveral ſounds.

Heat, according to the ſame author, is only an accident of light, occaſioned by the rays putting a fine, ſubtile etherial medium, which pervades all bodies, into a vibrative motion, which gives us that ſenſation.

From the vibrations, or pulſes of the ſame medium, he accounts for the alternate fits of eaſy reflection, and eaſy tranſmiſſion of the rays.

In the Philoſophical Tranſactions it is obſerved, that the butterfly, into which the ſilk-worm is transformed, makes 130 vibrations, or motions of its wings, in one coition.

VIBURNUM, the wayfaring, or pliant meally-tree, in botany, a tree, the flower of which has a ſmall permanent empalement, which is cut into five parts; it has one bell-ſhaped petal, cut at the brim into five obtuſe ſegments, which are reflexed; it has five awl-ſhaped ſtamina the length of the petal, terminated by roundiſh ſummits, and a roundiſh germen, ſituated under the flower, having no ſtyle, but the place is occupied by a roundiſh gland, and crowned by three obtuſe ſtigmas. The germen afterwards turns to a compreſſed fruit with one cell, incloſing one hard ſeed.

There are eight ſpecies of this plant, the firſt of which grows naturally in many parts of Europe, and is the common viburnum or lantana of the old botaniſts. The leaves are heart-ſhaped, much veined, irregularly ſawed on their edges, and are very woolly on their under ſide. The ſtalks are woody, and riſe twelve or fourteen feet high, ſending out ſtrong ligneous branches, which are covered with a light coloured bark; theſe are terminated by umbels of white flowers, whoſe ſummits are red, and are ſucceeded by roundiſh compreſſed berries, which turn firſt to a bright red colour, and are black when ripe, incloſing one ſeed of the ſame ſhape.

There is a variety of this with variegated leaves, which is preſerved in ſome of the gardens near London; but when the plants are removed into good ground, and are vigorous, their leaves become plain.

The ſecond ſort grows naturally in moſt parts of North America, where it is commonly called black haw.

This

This riſes with a woody ſtalk ten or twelve feet high, covered with a brown bark, and ſends out branches from the ſide; theſe, when young, are covered with a purple ſmooth bark, and are garniſhed with oval ſmooth leaves, which are ſlightly ſawed on their edges, and ſtand upon ſhort ſlender footſtalks, ſometimes oppoſite, and at others without order. The flowers are diſpoſed in ſmall umbels, which come out from the ſide and at the end of the branches; they are white, and ſmaller than thoſe of the common viburnum; theſe are ſucceeded by berries, which ripen in autumn.

The third ſort grows naturally in North America. The ſtalks of this ſort are ſoft and pithy, and branch out greatly from the bottom upward. The bark is of a grey colour; the leaves are roundiſh, oval, ſtrongly veined, and ſawed on their edges, of a light green colour, and placed oppoſite upon pretty long foot-ſtalks. The flowers are diſpoſed in a corymbus at the end of the branches, which are white, and almoſt as large as thoſe of the common ſort; theſe appear the latter end of June, but are ſeldom ſucceeded by ſeeds in England.

The fourth ſort is the lauruſtinus with ſmall leaves, which are hairy on their under ſide; this plant is ſo well known as to need no deſcription, but as it is frequently confounded with the next, it may be neceſſary to point out its difference. The leaves of this are ſeldom more than two inches and a half long, and one and a quarter broad; they are rounded at their baſe, but end in acute points; they are veined and hairy on their under-ſide, and are not of ſo lucid a green colour on their upper-ſide. The umbels of flowers are ſmaller, and appear in autumn, continuing all the winter, and the plants are much hardier.

The fifth ſort is commonly known in the nurſery-gardens by the title of ſhining leaved lauruſtinus. The ſtalks of this riſe higher, the branches are much ſtronger than thoſe of the former ſort. The bark is ſmoother, and turns of a purpliſh colour; the leaves are larger, of a thicker conſiſtence, and of a lucid green colour; the umbels are much larger, and ſo are the flowers: theſe ſeldom appear till the ſpring, and when the winters are ſharp, the flowers are killed, ſo never open unleſs they are ſheltered. The plants of this ſort were formerly kept in tubs, and houſed in winter, and, when they were ſo treated, made a fine appearance early in the ſpring, and in very mild ſeaſons the plants in the open air do the ſame.

There is a variety of this with variegated leaves, which makes as good a figure as any of the ſtriped plants which are preſerved in gardens.

The ſixth ſort is a native of North America, where it riſes to the height of ten or twelve feet, ſending out branches on every ſide their whole length; theſe have a ſmooth purpliſh bark, garniſhed with oval entire leaves, of a thick conſiſtence, and of a lucid green; they ſtand oppoſite. The flowers are produced in umbels at the end of the branches; they are white, and not unlike the flowers of lauruſtinus; theſe appear in July, and are ſucceeded by berries, which ſeldom ripen in England.

There ſeems to be two ſorts of this in the gardens, one of which comes from the more northern parts of America, and ſheds its leaves in winter; the other, which grows in Carolina and Virginia, is an ever-green; but both are ſo much alike in ſummer, as ſcarce to be diſtinguiſhed.

The ſeventh ſort is the common marſh-elder, which grows naturally in marſhy grounds, and on the ſides of rivers in many parts of England, ſo is not often kept in gardens; it is called by ſome of the nurſery-gardeners guelder-roſe with flat flowers, to diſtinguiſh it from the other, whoſe flowers are globular. The marſh-elder is the original ſpecies, and the guelder-roſe is a variety which accidentally aroſe from it. The former has a border of male flowers, which are large, and the middle of the umbel is compoſed of hermaphrodite flowers, which are ſucceeded by oval red berries; the latter has all male flowers, of the ſame ſize and ſhape with thoſe of the border of the firſt, ſo that they ſwell out into a round figure, which has occaſioned ſome country people giving it the name of ſnow-ball tree. This ſort is cultivated in gardens for the beauty of its flowers, which make a fine appearance during their continuance.

It will riſe to the height of eighteen or twenty feet, if it is permitted to ſtand. The ſtem becomes large, woody, and hard; the branches come out oppoſite, and are apt to grow irregular; they have a grey bark. The leaves are placed oppoſite; they are divided into three or four lobes, ſomewhat like thoſe of the maple, jagged on their edges, and of a light green colour. The flowers come out at the end of the branches: thoſe of the firſt in large umbels, and thoſe of the ſecond in a corymbus; they are very white, and appear the beginning of June; thoſe of the firſt have oval berries ſucceeding the hermaphrodite flowers, which turn of a ſcarlet colour when ripe, but the other, having only male flowers, are barren.

The eighth ſort grows naturally in Carolina and ſome other parts of North America; this riſes with a ſhrubby ſtalk eight or ten feet high, ſending out many branches, which are covered with a ſmooth purple bark, garniſhed with heart-ſhaped oval leaves, ending in acute points; they are deeply ſawed on their edges, have many ſtrong veins, and ſtand upon very long ſlender foot-ſtalks oppoſite. The flowers are collected into large umbels at the end of the branches; thoſe ranged on the border are male and barren, but the middle is compoſed of hermaphrodite flowers, which are ſucceeded by oval berries. The flowers are white, and the berries are red when ripe.

The firſt ſort may be propagated either from ſeeds, or by laying down the tender branches; but the former method being tedious, is ſeldom practiſed, becauſe the ſeeds ſeldom grow the firſt year, unleſs they are ſown in autumn; and as the branches eaſily put out roots, that is the more expeditious method.

The beſt time for laying theſe branches is in autumn, juſt as the leaves begin to fall; the manner of laying them being the ſame as for other hardy trees, need not be here repeated. By the ſucceeding autumn the layers will be rooted, when you may take them off from the old plants, and tranſplant them into a nurſery for two or three years, in which they may be trained up to regular ſtems and heads, and may afterwards be planted where they are to remain.

The ſecond ſort is generally propagated by layers here, becauſe the ſeeds do not often ripen in England. The young ſhoots of this take root very freely; the cuttings will alſo take root, if they are planted in autumn; the ſeeds, when they are brought to England, always remain in the ground a year, like thoſe of the other ſorts, ſo that the propagating the plants by ſeeds is a tedious method.

The lauruſtinuſes are propagated by laying down their young branches, which put out roots very freely; ſo that when they are layed in autumn, they will be well rooted by that time twelve months, when they ſhould be taken off from the old plants, and may either be planted where they are to remain, or into a nurſery to grow two years to get ſtrength. The beſt ſeaſon to tranſplant theſe is at Michaelmas, that they may get new root before winter; for as theſe plants begin to flower early in winter, it is a plain indication of their growing at that ſeaſon, ſo they will more ſurely ſucceed than at any other time of the year, though they may be removed in the ſpring with balls of earth to their roots, provided it is done before they begin to ſhoot; they may alſo be removed the latter end of July or the beginning of Auguſt, if rain happens at that time; for after they have done ſhooting, which is ſoon after Midſummer, they will be in no danger, provided they are not kept out of the ground any time.

Theſe plants may alſo be propagated by ſeeds, which ſhould be mixed with earth in autumn, ſoon after they are ripe; theſe ſhould be expoſed to the open air, and receive the rain in winter, and in the ſpring they may be ſown upon a gentle hot-bed, which will bring up the plants; theſe ſhould remain in the bed till autumn, and then they may be tranſplanted and treated in the ſame way as the layers. I have raiſed many of theſe plants from ſeeds, which I find hardier than thoſe raiſed by layers.

Some people train up the lauruſtinus with naked ſtems to have round heads, but if theſe are planted in the open air, they will be in more danger of ſuffering by ſevere froſts, than thoſe whoſe branches grow rude from the bottom; for if the froſt kills the outer part of the ſhoots, the ſtems will be protected, ſo will ſoon put out new branches; but where the ſtems are naked, the froſt frequently kills them to the root.

The ſixth ſort may be propagated in the ſame way as the lauruſtinus, and requires the ſame treatment; it loves a ſoft loamy ſoil, and ſhould have a ſheltered ſituation.

The ſeventh and eighth ſorts are eaſily propagated by layers or cuttings. The common guelder-roſe ſends out plenty of ſuckers from the roots, by which it is frequently propagated; but as the plants ſo raiſed are very ſubject to put out ſuckers, they are not ſo good as thoſe which come from layers or cuttings. Both theſe ſorts have a moiſt ſoil, in which they will make much greater progreſs, and produce their flowers in greater plenty than on a dry ſoil.

They are both very hardy, ſo will thrive in the coldeſt ſituations, but not within the ſpray of the ſea. The common guelder-roſe is ſeldom ſuffered to ſtand very long in gardens, but I have ſeen one in an old garden, whoſe ſtem was more than two feet and a half round. *Miller's Gard. Dict.*

VICAR, a perſon appointed as deputy of another; to perform his functions, in his abſence, and under his authority.

The pope pretends to be vicar of Jeſus Chriſt on earth.—He has under him a grand-vicar, who is a cardinal, and whoſe juriſdiction extends over all prieſts both ſecular and regular; and even, in many caſes, over laymen.

Among the ancient Romans, vicar was a legatus, or lieutenant, ſent into the provinces where there was no governor; ſo that the vicarii were properly the emperor's vicars, not thoſe of governors.

Italy, in the time of the Eaſtern empire, was governed by two vicarii, the one vicar of Italy, who reſided at Milan; the other vicar of the city, who reſided at Rome.

Cujas obſerved, that the word vicar was ſometimes, though rarely, attributed to the lieutenant-generals of proconſuls, or governors of Roman provinces.

VICAR, in the canon law, denotes a prieſt of a pariſh, the predial tithes of which are impropriated, or appropriated; that is, belong either to a chapter, religious houſe, &c. or to a layman, who receives them, and only allows the vicar the ſmall tithes, or a convenient ſalary, anciently called *portia congrua*.

He is thus called, as ſerving for, or in lieu of a rector, who would be entitled to the great tithes.

Theſe vicars were anciently called *perpetui vicarii*, becauſe not appointed by the impropriator, and licenſed by the biſhop to read ſervice; but preſented by the patron, and canonical inſtitution given them by the hands of the ordinary; and ſo having conſtant ſucceſſion, or corporations, and never dying.

The canoniſts mention four ſpecies of vicars; ſome perpetual; others appointed for a certain time, and on ſome ſpecial occaſion, called *mercenarii*; others called *ſpeciales*, appointed not for the whole cure, but for ſome certain place, article, or act: others *generales*, neither perpetual, nor appointed for any certain act, but for all things in the general.

VICAR GENERAL, was a title given by king Henry VIII. to Thomas Cromwell, earl of Eſſex; with full power to overſee the clergy, and regulate all matters relating to church affairs.

VICE, *Vitium*, in ethics, is ordinarily defined an elective habit, deviating, either in exceſs, or defect, from the juſt medium wherein virtue is placed.

It is called a habit, to diſtinguiſh it from ſin, which is only an act: hence, a ſin is looked on, as ſomething tranſient; and a vice, as ſomething permanent.

Authors diſtinguiſh three ſtates of vice: the firſt *incontinentiæ*, of incontinence; wherein a perſon ſees, and approves the good, but is hurried to evil by the violence of his paſſions. The ſecond, *intemperantiæ*, of intemperance; wherein, even the judgment is depraved and perverted.—The third, *feritatis*, of obduracy; wherein the perſon is totally immerſed in vice, without any ſenſe or feeling thereof.

The ſtate of incontinency is conſidered as infirmity, wherein the perſon feels the ſharpeſt ſtings of conſcience: that of intemperance, as malice, wherein the remorſe is not ſo lively.—In that of obduracy there is none. See HABIT, VIRTUE, &c.

VICE, in ſmithery, and other arts employed in metals, &c. is a machine or inſtrument, ſerving to hold faſt any thing they are at work upon; whether it be to be filed, bent, or riveted, &c. For a particular deſcription of the vice, ſee the article SMITHERY.

Hand-VICE, is a ſmall kind of vice ſerving to hold the leſſer works in, that require often turning about.

Of theſe there are two kinds, the broad chapped hand-vice, which is that commonly uſed; and the ſquare-noſed hand-vice, ſeldom uſed but for filing ſmall round work. See SMITHERY.

VICE is alſo a machine uſed by the glaziers, to turn, or draw lead into flat rods, with grooves on each ſide, proper to receive the edges of the glaſs.

This machine conſiſts of two iron chaps, or cheeks, joined with two croſs iron pieces. In the ſpace between the chaps, are two ſteel wheels, and their ſpindles, or axes paſſed through the middle; each of which has its nut, or pinion with teeth, that catch into each other: and to the loweſt is fitted a handle, whereby the machine is turned.

There are ſome of theſe vices double, and that will draw two leads at once: theſe have three wheels.—Some glaziers will turn lead of different ſizes in the ſame vice, by changing their cheeks for each ſize.

With another pair of ſpindles, whoſe nuts almoſt meet, they turn lead for tiers, by the glaziers called bands, which when it comes out of the vice, is almoſt cut aſunder, in two thickneſſes, eaſy to be parted. Before the invention of this vice, which is but a late thing, they uſed a plane; accordingly, in all the ancient windows, we find the lead planed, and grooved that way.

VICE is alſo uſed, in the compoſition of divers words, to denote the relation of ſomething that comes inſtead, or in the place of another.

VICE-ADMIRAL, is one of the three principal officers of the royal navy; who commands the ſecond ſquadron, and has his flag ſet up in the fore-top of his ſhip.

VICE-CHAMBERLAIN, called alſo, in ancient ſtatutes, under-chamberlain, is an officer in the court, next under the lord chamberlain; and who in his abſence, has command, and control, of all officers belonging to that part of the houſhold called the chamber above ſtairs.

VICE-CHANCELLOR *of a Univerſity*, is an eminent member, choſe annually, to manage affairs in the abſence of the chancellor.

VICE-DOGE, is a counſellor of Venice, who repreſents the doge, when ſick, or abſent; that the ſeignory may never be without a chief.

VICE-ROY, a governor of a kingdom, who commands in the name and ſtead of a king, with full and ſovereign authority.

VICE-VERSA, a Latin phraſe, importing on the contrary: thus, as the ſun mounts higher and higher above the horizon, the ſhadows of things decreaſe; and *vice verſa*, as he deſcends lower, they increaſe.

VICISSITUDE, the regular ſucceſſion of one thing after another; as the viciſſitude of a day and night, of the ſeaſons, &c.

VICOUNT, in old law books, ſignifies the ſame with ſheriff.

VICOUNT, or VISCOUNT, is alſo a degree of nobility next below a count, or earl, and above a baron. See the articles NOBILITY, EARL, &c.

VICOUNTIEL, in law-books, ſomething belonging to, or falling within the ſheriff's juriſdiction: thus writs vicountiels are writs triable in the ſheriff's court; and there are certain vicountiel rents, of which the ſheriff keeps a particular roll, that uſually comes under the title of firma comitatus.

Alſo vicountiel juriſdiction, is that which belongs to officers of a county; as ſheriff, &c.

VICTIM, *Victima*, denotes a bloody ſacrifice offered to ſome deity, of a living creature, as a man or beaſt, which is ſlain to appeaſe his wrath, or obtain ſome favour.

VICTIMARIUS, in antiquity, a miniſter or ſervant of the prieſt, whoſe office was to bind the victims, and prepare the water, knife, and other things neceſſary for the ſacrifice.

To the victimarii it alſo belonged to knock down and kill the victims, in order to which they ſtood cloſe by the altar naked to the waiſt, but crowned with laurel; and holding a hatchet or a knife, up, aſked the prieſt leave to ſtrike; ſaying, Agone? whence they were called agones and cultellarii.

When the victim was killed, they opened it, and after viewing the entrails, took them away, waſhed the carcaſe, ſprinkled the flour on it, &c. The ſame victimarii lighted the fire wherein books were condemned to be burnt.

VICTORY, *Victoria*, the overthrow or defeat of an enemy, in war or combat.

VICTUALLING-OFFICE, an office kept on Tower-hill, London, for the furniſhing his majeſty's navy with victuals.

It is managed by ſeven commiſſioners, who have their inferior officers, as ſecretaries, clerks, &c. beſides agents in divers parts of Great Britain, Ireland, &c. See COMMISSIONERS, &c.

VICTUALS, ſignifies any ſuſtenance, or things neceſſary to live upon, as meat and proviſions; which are to be ſold at a reaſonable price, aſſeſſed by juſtices, &c. on pain of forfeiting double the value. By the cuſtom of ſome manors, they chooſe yearly ſurveyors of victuals.

VI ET ARMIS, in law, are words made uſe of in indictments and actions of treſpaſs, to ſhew the violent commiſſion of any treſpaſs or crime; but in an appeal of death, or where a perſon is killed with a weapon, theſe words are not held neceſſary, becauſe the violence is implied.

VIEW, in law, ſignifies the particular act of viewers; as where a real action is brought, and the tenant does not certainly know what land it is the defendant requires; then he may pray that the jury may view the ſame, that is to ſay, ſee the land that is claimed. But it is held, that in all caſes of viewing, the thing in controverſy is only to be ſhewn to the jurors, and no evidence can be given relating to it on either ſide: and here if waſte be alledged to be done, the view of the houſe generally is ſufficient.

VIEW *of frank Pledge*, is the office which the ſheriff in his county-court, the ſteward in the leet, or the bailiff in his hundred, performs in looking to the king's peace, and ſee that every man be in ſome pledge.

VIGILS, in church-hiſtory, are the faſts appointed before certain feſtivals, in order to prepare the mind for a due obſervation of the enſuing ſolemnity.

VIGINTIVIRATE, a tribunal or court among the ancient Romans, firſt eſtabliſhed by Cæſar, conſiſting of twenty members, three of whom judged of all criminal matters; three others had the inſpection of the coins; four others had the inſpection of the ſtreets of Rome; and the reſt were judges of civil affairs.

VILLAGE, an aſſemblage of houſes, inhabited chiefly by peaſants and farmers, and having no market, whereby it is diſtinguiſhed from a town.

Fleta tells us, that the difference made between a manſion, a village, and a manor, is this, viz. a manſion may conſiſt of one or more houſes, but muſt be of one dwelling-place, and none near it; for if any other houſes are contiguous, it is then a village; and a manor conſiſts of ſeveral villages, or of one alone.

Where in legal proceedings a place is named generally, it ſhall be taken for a vill, becauſe as to civil purpoſes the kingdom was firſt divided into vills; yet it has been held, that a vill and a pariſh ſhall be intended the ſame.

VILLAIN, or VILLEIN, *Villanus*, in our ancient cuſtoms, denotes a man of ſervile and baſe condition, viz. a bondman or ſervant: and there were anciently two ſorts of bondmen or villains in England; the one termed a villain in groſs, who was immediately bound to the perſon of his lord and his heirs; the other a villain regardant to a manor, he being bound to his lord as a member belonging and annexed to the manor whereof the lord was owner; and he was properly a pure villain, of whom the lord took redemption to marry his daughter, and to make him free; and whom the lord might put out of his lands and tenements, goods, and chattels at his will, and beat and chaſtiſe, but not maim him.

VILLENAGE, a kind of ancient tenure, whereby the tenant was bound to do ſuch ſervices as the lord commanded, or ſuch as were fit for villains or bondmen to perform.

VILLI, among botaniſts, a kind of down like coarſe hair, or the grain or ſhag of pluſh, with which ſome trees abound.

VILLOSE, or VILLOUS, ſomething abounding with villi, or fibres like coarſe hairs: ſuch is one of the coats of the ſtomach. See STOMACH.

VINCA, periwinkle, in botany, a genus of plants, whoſe flower is monopetalous and ſaucer-ſhaped, with an horizontal limb divided into five obtuſe ſegments; the ſtamina conſiſts of five very ſhort inflexed filaments, topped with erect, obtuſe, membranaceous antheræ; the fruit conſiſts of two erect cylindri huſks opening longitudinally with one valve, and contains a number of oblong, cylindric, and furrowed ſeeds.

A ſpecies of this genus, which grows naturally on the iſland of Madagaſcar, is exceeding beautiful, and continues in full bloſſom all the ſummer, but being tender, requires a ſtove in this climate for its preſervation.

This kind is eaſily propagated by cuttings in any of the ſummer months.

The common periwinkle grows wild among hedges, &c. in many parts of England; it has a fibrous root, with ſlender trailing ſtalks, furniſhed with oblong, ever-green leaves; it begins to flower in the ſpring, and continues a ſucceſſion of bloſſoms for a long time.

It is ſaid to be vulnerary, aſtringent, and febrifuge; and is given to abate all kinds of bleeding: the freſh leaves applied to the ſwellings of the king's evil, mixed with lint, are accounted by ſome an excellent remedy to diſcuſs and diſſolve them.

VINCULUM, in mathematics, a character in form of a line, or ſtroke, drawn over a factor, diviſor, or dividend, when compounded of ſeveral letters or quantities, to connect them, and ſhew they are to be multiplied, or divided, &c. together by the other term. Thus $\overline{d \times a+b-c}$ ſhews that d is to be multiplied into $a+b-c$.

VINDEMIATING, the gathering of the grapes, or other ripe fruits, as the apples, pears, cherries, &c.

VINDEMIATRIX, or VINDEMIATOR, a fixed ſtar of the third magnitude in the conſtellation Virgo. See VIRGO.

VINDICATION, or claiming, in the civil law, an action ariſing from the property a perſon has in any thing; or a permiſſion to take or ſeize a thing, as one's own, out of the hands of a perſon, whom the law has doomed not to be the true proprietor.

VINE, the name of a ſhrub of the reptile kind, which is with good reaſon preferred to all others, both for the ſweetneſs of its fruit, and for the eaſe with which it repays the labour beſtowed on its culture.

It grows as happily in plains as upon hills, and thrives as well in a ſtrong ſoil, as in that which is looſe and open; alſo in poor as well as in rich land, and in a dry as well as in a moiſt ſoil. It alone beſt endures the intemperature of heat, cold, or ſtormy weather.

Nevertheleſs, it is of great importance that the quality of the vine be adapted to the condition of the country: for neither is the culture the ſame in every ſoil and climate, nor are all vines of the ſame kind. It is not eaſy to ſay which is the beſt; experience teaching us, that every country has its own, which is more or leſs proper for it. A judicious huſbandman will however eaſily find, that vine is proper for the plain, which bears fogs and hoar-froſt without being hurt; and for a hill, that which

can bear drought and wind. He will plant in a rich and fertile ſoil, a ſlender vine, which does not bear plenty of fruit; in a ſtiff ſoil, one that makes ſtrong ſhoots and is covered with plenty of leaves; and in a looſe ſoil one that makes but few ſhoots. He will find, that it is not proper to commit to a moiſt place a vine which bears tender and large grapes; nor to a dry place, a of vine a contrary quality.

The good huſbandman will alſo know, that the nature of the climate is of great conſequence; whether it be hot or cold, wet or dry, ſubject to hail and wind, or calm, clear, or cloudy. Two ſorts of vines are fit for a cold and cloudy ſituation, viz. either one which is early, and ripens its fruit before the winter; or one of firm and hard grapes, which bloom in the midſt of fogs, and afterwards mellow with the cold and hoar-froſt, as other grapes do with warmth. Where wind and ſtorms are frequent, the vines muſt take deep root and have hard grapes: where the ſituation is warm, they may be of more tender and more fruitful kinds. Vines whoſe grapes rot with rain and conſtant dews ſhould be planted in dry places; and thoſe in moiſt, which are hurt by drought. If any vines are planted in places ſubject to hail, it ſhould be thoſe which have large and ſtrong leaves; becauſe they will ſhelter the fruit. Where the ſky is uſually ſerene and fair, all ſorts of vines will grow: and thoſe may be planted to advantage, whoſe grapes fall quickly off.

Could we have the quality of the ſoil, the ſituation of the place, and the ſtate of the weather to our wiſhes; that ſoil ſhould be preferred, which is neither too ſtrong nor too looſe, but rather inclining to looſe; neither poor, nor exceeding rich, but rather fertile. The ſituation ſhould neither be a plain, nor ſteep, but yet on a riſing ground; it ſhould neither be wet nor dry, yet moderately moiſtened with dews: it ſhould neither have ſprings on the ſurface, nor at ſome depth in the earth; and yet it ſhould communicate to the vines a moiſture which is neither bitter nor ſalt; for either of theſe will vitiate the taſte of the wine, and give a ſcurvy rough coat to every plant that grows on ſuch land. The ſtate of the moiſture may be known, by diſſolving ſome of the earth in water. The vine does not proſper either in a frozen, or in a ſcorching hot climate; but it thrives beſt in a country that is rather warm than cold. It is hurt more by rain, than by dry weather, and proſpers better in a dry climate, than where rains are frequent. It delights in gentle and moderate gales, but is greatly damaged by ſtorms.

It is an obſervation of long ſtanding, that ground which has never been plowed, or had trees growing on it, is the beſt for a vineyard. All authors agree, that an old vineyard is the worſt of any for making a new plantation; becauſe the earth is entangled with the old roots of the vines matted together, poiſoned by their decay, and quite exhauſted by their long ſtanding. Woodlands may be uſed, becauſe the roots of common trees and ſhrubs are eaſily extirpated. Where there is no unplowed land, the next beſt is a corn field, free from trees, or where trees have not been planted thick.

The fitneſs of new ground for the vine may be judged of by the ſhoots of ſuch ſhrubs as grow naturally in it: for if they make thriving ſhoots, which have not a ragged or ſtinted appearance, the vine will flouriſh there. Of all ſoils, a black rich mould is the beſt for vines. Stones which crumble, or rot as it were, with the weather, being broken, and laid to the roots of the vines, retain a moiſture, cool them, and, by that means, are exceeding fit for nouriſhing them. For the ſame reaſon gravel, pebbles, and looſe ſtones are approved of, provided they be mixed with rich mould: but if they are mixed with poor earth, they are bad. Flints are likewiſe very friendly to vines, if covered with a moderate depth of earth; becauſe, being cold, they retain the moiſture, and prevent the roots being parched up in the dog-days. The foot of mountains, which receive the earth waſhed down from their tops; or vallies, to which additions are made by the ſettling of rivers, which overflow them, are very proper for vineyards. A chalky bottom is fit for the vine; but clay, not excepting even that which approaches to marle or potter's clay, is very unfit; as is alſo coarſe hungry ſand. On mountains and riſing grounds, and on the ſides of hills, vines do not eaſily take firm root; but they yield wine of a laſting and excellent flavour. In moiſt and level places, vineyards are exceeding ſtrong; but they produce wine of a weak flat taſte, which does not keep long.

It may be eſtabliſhed as a general rule, to plant vineyards in cold countries ſo as to face the ſouth, and in warm countries facing the eaſt, unleſs they are ſubject to ſtorms from that quarter, in which caſe it is better that they face the north. In exceeding hot countries, ſuch for example as Egypt, it will be beſt to expoſe them to the north.

Mr. Miller ſays, that the beſt ſoil for a vineyard, in England, is that whoſe ſurface is a rich ſandy loam, and not above a foot and an half, or two feet deep, lying upon gravel or chalk; either of which bottoms is equally good for vines. If the ſoil is deep, or the bottom either a clay or ſtrong loam, it is by no means proper for this purpoſe: for though the vines may ſhoot vigorouſly, and produce a great quantity of grapes; yet we have not ſun to ripen them ſufficiently. If the ſoil is too deep, the roots of the vine will run to too great a depth to receive the influences of the ſun and air; whence the juices of their fruit will be crude.

According to him, our vineyards ſhould be planted on the north ſide of a river, upon an elevation inclined to the ſouth, with a very gradual deſcent, that the ſuperfluous moiſture may be the better drained off. Yet if the ground ſlopes too much, it is by no means proper for this purpoſe. Hills to the north, as they ſhelter the vineyard from cold, and reflect the heat, will be of great advantage. The country round about ſhould be open and hilly, to preſerve the air dry. The vineyard ſhould be open to the eaſt, that it may enjoy the morning ſun, to dry up the ſuperfluous moiſture.

Dr. Beal, in N°. 116 of the Philoſophical Tranſactions, after having mentioned ſome inſtances of the warmth ariſing from ſtones under ground, eſpecially lime-ſtone, and ſome kinds of pebbles, is of opinion, that, as I obſerved before (quoting this very paſſage more at large), many of our hills and rocks might be greatly improved: for it would be no hard taſk, ſays he, to ſhovel down the ſhallow and moſſy turf from the ſteepeſt declivities, into places, where it may have ſome receptacle or ſtay; and there to impregnate it, with the ſpade and compoſt, for garden or vineyard.

The ground muſt firſt of all be cleared of the roots of trees or ſhrubs, or whatever elſe can be a hindrance to the diggers, or might afterward preſs down the trenched earth, by its weight, or by the treading of thoſe employed in carrying it off. It is of great importance that the earth be kept extremely looſe, even, if poſſible, without a foot touching it, in order that the mould, being all equally ſtirred, may eaſily give way to the young tender roots, wherever they extend themſelves, and inſtead of obſtructing them by its hardneſs, receive them into its tender nouriſhing boſom, which, in that ſtate, readily admits the ſhowers and other influences from above, and diſpenſes them equally to all parts, for the nouriſhment of the young plants.

A plain or valley muſt be trenched two feet and an half deep, and a riſing ground three. A ſteeper hill muſt be trenched four feet deep: for when the mould is turned down from a higher place, it can hardly be thrown up again to a ſufficient depth, unleſs the trenches are made deeper. Beſides, I never approve, ſays Columella, of planting a vine leſs than two feet deep, even in a valley; for it is better not to plant it at all, than to leave its roots too near the ſurface ſuſpended from the nouriſhing moiſture, which lies low, except where ſprings riſe near the ſurface: there indeed the ground muſt not be trenched above a foot and a half deep.

The trenches muſt be made equally deep all the way to the bottom, the ſides being perpendicular, and the ground marked out by a line, which muſt be carried forward as the work proceeds, always at equal diſtances, till the whole ground is equally trenched. Where the bottom is of a binding nature, it is of great advantage

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to lay in the bottom of the trenches, ſmall ſtones, or other rubbiſh, to carry off the water, which otherwiſe, ſtagnating there, would chill the tender roots. In order to do this the more effectually, the bottom of the trenches are made ſomewhat convex towards the middle, the better to convey the water to drains cut at the extremities of the vineyard.

If neceſſity forces to replant an old vineyard, all remains of the old vines muſt be extirpated. The ground ought then to be dunged with old dung, if it can be had, if not with new, and trenched moſt carefully, picking out every remaining root, which ſhould be collected and burnt. The trenched earth ſhould then be covered with old dung, which does not breed weeds, or with freſh earth brought from among thickets. Columella adviſes particularly, to have a careful overſeer to inſpect the workmen, and to be watchful that they do not make baulks.

Mr. Miller, inſtead of trenching the ground as the ancients did, propoſes giving it a ſummer fallow, plowing it as deep as the ſoil will admit of, and clearing it of roots, weeds, or whatever elſe can obſtruct the growth of the plants.

Columella adviſes great care to be taken in the choice of the vine from which the cuttings are taken, and is therefore againſt purchaſing ſtrange plants at a venture, which may come from a ſoil and climate different from that they are intended for, and may not be of the ſort of vine which is deſired. A vine cannot be ſaid to be fruitful, becauſe it bears many grapes; for this may ariſe from the largeneſs of the trunk, and the great number of bearing ſhoots, which may have but a ſingle bunch on each. If ſeveral bunches of grapes are ſeen to hang from each ſhoot: if from each bud left the former year, ſhoots with fruit ſpring forth; if the ſhoots which ſpring out of the trunk of the vine have ſome bunches; and if even the ſecondary ſhoots, or thoſe which grow out the preſent year's ſhoots, bear grapes; that vine may undoubtedly be eſteemed fruitful, and fit to afford cuttings. Whoever has this much at heart, will mark the vines which have been the moſt fruitful, and have yielded the ripeſt and ſoundeſt grapes, with ochre and vinegar, that it may not be waſhed off by the rain. Nor is this to be done for one year only; but the vines ought to be examined for three or more vintages, to know whether they preſerve the ſame degree of fruitfulneſs: for then it will be certain, that the fruitfulneſs muſt be owing to the good quality of the vine, and not to a favourable ſeaſon. Whatever grapes come to their full maturity without being rotted or damaged, for ſeveral ſeaſons running, will yield more and higher flavoured wine, than any others.

It is not enough that the ſtock from which the cuttings are taken be fruitful, but they muſt alſo be taken from thoſe parts of it which promiſe the greateſt fruitfulneſs. Thoſe which grow from the ſtem or old wood of the vine, ſeldom bear fruit, or produce fruitful vines. Thoſe which grow from the ſummit of the vine are reckoned too luxuriant to plant; and though the number of cluſters on them may promiſe fruitfulneſs, yet they ſhould not be relied on; but rather thoſe which grow out of the middle of the vine, of which the wood is firmer than that of the former. This Columella calls the genital part of the vine; and ſays, that having followed reaſon as his guide, and alſo a long experience, he chooſes from that fruitful part of the vine, ſhoots which, bearing plenty of fruit already, promiſe fecundity for the time to come. He is not contented with ſingle cluſters, but chiefly approves of thoſe which have the moſt numerous offſpring; and adds, that the neglect of theſe rules has rendered many vineyards leſs fruitful, indeed ſome quite barren, when the cuttings have been very improperly choſen.

Some are of opinion, that the whole ſhoot, as it is taken from the ſtem, is fit for planting; and for that end, they cut it into pieces of five or ſix eyes, each of which they plant. Others, with more reaſon, think that no part of the ſhoot is fit for being formed into a cutting, but only that part of it which is next to the wood of the former year: for every bearing ſhoot abounds in fruit below the fifth or ſixth eye. The reſt either bears no fruit, or produces only ſlender twigs. The antients, ſays Columella, always preſerved ſome of the old wood to the cuttings: but experience has ſhewn that this is wrong; for whatever is left of the old wood ſoon roots, when it is moiſtened and covered with earth, and kills the tender rots next to it; and when this happens, the whole vine ſhrivels, or is burnt up. Whatever remains of the old wood ſhould therefore be cut off, where the ſhoot grows to it, that the ſhoot may be planted with its own ſmall head. Mr. Miller differs here in opinion from Columella; for he directs, that the ſhoots ſhould be cut from the old vine, juſt below the place where they were produced, taking a knot, or piece of the two years old wood to each, which, ſays he, ſhould be pruned ſmooth.

Were cuttings, thus choſen, taken from the vines every time they are pruned, for ſeveral vintages, and carefully planted, vineyards might be raiſed, which would yield plenty of the moſt generous wines; nor need we grudge this delay; for when once we are aſſured of the fruitfulneſs of a vine, it may be multiplied by engrafting. This, ſays Columella, you, Publius Silvinus, can witneſs: for, from one early vine on your eſtate, I engrafted the ſtocks of two jugera of vineyard in two years. How much therefore, may the vine be multiplied from theſe two jugera, ſeeing that theſe are the offspring of only one?

There are two ways of planting vineyards, viz. either with cuttings, or with vines which have already taken root. Theſe laſt are called quickſets. In the provinces, ſays Columella, they plant cuttings, for they will not be at the trouble of having nurſeries. The expert huſbandmen in Italy approve of this practice, becauſe the quickſets are attended with ſeveral advantages. They are leſs apt to die; and by reaſon of the greater firmneſs of their wood, they ſuſtain better the extremities of heat and cold, and other intemperatures of the weather: and the tranſplanting of them quickens their producing grapes. Cuttings may do in a looſe yielding mould; but a ſtrong heavy ſoil muſt have rooted vines, or quickſets.

Mr. Miller prefers good cuttings to rooted vines, for planting a vineyard; becauſe the roots of vines do not grow ſtrong and woody, as moſt ſorts of trees do, but are long, ſlender and pliable; and therefore, after they have been taken up, they ſeldom ſtrike out any fibres from the weak roots: but theſe generally ſhrivel and die, and thereby rather retard, than help, the plants in their growth, by preventing the new fibres from puſhing out.

This difference of opinion between Columella and Mr. Miller may be accounted for, from the different depths at which they direct the vines to be planted: for were cuttings to be planted two feet and an half deep, no roots would ſhoot out from their loweſt part; and if the rooted vines were planted ſo ſuperficially in Italy as Mr. Miller adviſes, they would be dried up by the ſun.

Columella directs that the nurſery be made, neither in a poor hungry ſoil, nor in an ouſy wet one; yet where there is moiſture enough; and in a middling rather than a rich ſoil; becauſe, though cuttings take root ſoon, and make ſtrong ſhoots in a rich ſoil; yet, when tranſplanted, they ſhrivel, and ſeldom recover. It is therefore the huſbandman's intereſt, rather to tranſplant from a middling ſoil to a rich one, than from a rich to a poorer. From a rich ſoil to a rich ſoil, they will thrive apace. It is not adviſable to make the nurſery in very poor land, becauſe many of the cuttings will then die, and the others will arrive but ſlowly at a ſtate to bear being tranſplanted.

The nurſery ſhould be trenched to the depth of two feet and an half, and being formed into beds three feet wide, the cuttings are planted in them at about a foot diſtance from one another, every way. This may be done either in the ſpring or in autumn. The ſpring is beſt if the climate be cold, or ſubject to much rain, and the autumn if the climate be warm, and the ſoil dry, or ſituated on the ſide of a hill.

The length of the cuttings ſhould be regulated by the diſtance between their eyes: for when theſe are near one another, the cuttings may be ſhorter, and when they

are more diſtant, it ſhould be longer. This length ſhould not exceed a foot, nor ſhould it be leſs than three-fourths of a foot, leſt, being planted on the ſurface of the earth, the cutting ſhould periſh with drought in the ſummer; and, on the other hand, becauſe when a cutting planted too deep has taken root, it cannot be taken up without ſome difficulty. If the cuttings are planted on the ſide of a hill, their length may be about fifteen inches on ouſy ground, they need not have above three eyes, which may reduce them to nine inches, but certainly to more than ſix. In theſe three eyes are not included the numerous eyes which uſually are on the cutting, near the part where it is taken from the ſtem: beſides thoſe numerous eyes, there ſhould be three others, with joints. The cuttings ſhould be planted ſo deep, as that the uppermoſt eye may be level with the ſurface of the ground; becauſe all the ſap will then be employed in one ſingle ſhoot, which will conſequently be ſo much the ſtronger. They ſhould be planted as ſoon as poſſible after they are cut off the vine; and in doing this care ſhould be taken to avoid a ſtrong drying wind, or a ſcorching ſun. It is therefore beſt to chooſe a calm day, or at leaſt a day in which there is but little wind. The ſun may be kept off by ſhades, or any covering. The nurſery ſhould afterwards be kept clear of weeds, and be frequently dug. Only one ſhoot ſhould be reared, and that ſhould be faſtened to a ſtick or ſlender pole, to bear it off the earth. The reſt ſhould be carefully rubbed off; and this ſhoot ſhould be pruned down to two eyes in the autumn. The ſtrongeſt ſhoot from theſe eyes ſhould be reared the next ſummer; and with this management the cuttings will be fit to tranſplant at the end of thirty or thirty-ſix months.

Vines are likewiſe propagated by layers. For this purpoſe, a trench is dug four feet every way, that the layer may not be hurt by other roots. A ſhoot of the laſt year is then laid down in it, in ſuch manner as to make its end riſe at the farther part of the trench. Four eyes are left on that part of the layer which goes to the bottom of the trench, and they are to put out roots. All the eyes between them and the ſtem ſhould be rubbed off, to prevent the growth of uſeleſs ſhoots. Two, or at moſt three, eyes are left on the farther end, which riſes out of the earth, and all the reſt, between them and thoſe at the bottom of the trench, are rubbed off. The layer thus prepared ſoon takes deep root, and in the third year, it may be cut off from the mother vine. When the ſhoot is not long enough to riſe again out of the earth, Columella thought of the following method. The end of the ſhoot is brought to the bottom of the trench, and the four lower eyes, left for the roots to ſhoot from, are covered with earth, as before: but inſtead of the eyes at the extremity, as in the former way, the two eyes next the ſurface of the earth, of that part which come from the ſtem, are left to make ſhoots, which they readily do, and in the third year, the layer may be cut from the mother vine, as in the other caſe. In order to encourage the roots to ſtrike out, they need not be covered with the whole depth of earth the firſt year, unleſs it ſhould become neceſſary before the winter, to keep the roots from being chilled by water which might gather in the trench.

The ground being thoroughly prepared, by trenching, harrowing, and clearing it of every thing that can be hurtful to the vine, it is marked out, in order to be planted. The Romans planted their vines five feet aſunder in a poor ſoil, ſix feet aſunder in a middling ſoil, and at the diſtance of ſeven feet from each other in a rich ſoil. Sometimes too they left a ſpace of ten feet between them, that there might be ſufficient room for the ſtrong ſhoots to extend themſelves.

They generally planted their vineyards in a quincunx form, for which they marked out the ground by ſtretching acroſs it a line trimmed with bits of red cloth, or of ſome other conſpicuous colour, at ſuch diſtances from each other as it was intended to leave between the rows. A piece of reed was ſtuck into the earth at each ſpot indicated by the cloth, and this was repeated till the whole field was marked out in equal diſtances. The planter followed, and dug a hole at each alternate reed, two feet and an half deep in level ground, two feet and three quarters if it lay ſloping, and three feet deep where the declivity was conſiderable. He then removed the quickſets from the nurſery, taking them up with great care, and tranſplanted them the very ſame minute, if that was poſſible. All their ſhoots were previouſly pruned off, except one, which was the ſoundeſt and firmeſt, and of that only two eyes were left above ground. If any of the roots were hurt in taking them up, thro' all poſſible care was uſed not to injure them, they were cut off, very ſmooth. If two plants were ſet in the ſame hole, a few ſtones, of about five pounds weight, were laid between them in the bottom of the hole, to prevent their roots from interweaving together. They were likewiſe of opinion, that theſe ſtones ſaved the roots from being chilled in the winter, or ſcorched by the heat of the dog days in the ſummer. Mago adviſed to lay the huſks and ſtones of grapes mixed with dung, in the holes, under the roots of the vines, as a means of ſtrengthening them, and of haſtening the production of young roots. During the chilling wet of the winter, they gave a warmth; and in the ſummer, they afforded a nouriſhing moiſture.

Columella diſapproved greatly of putting two vines in the ſame hole, becauſe their roots conſtantly mingled together, and formed a kind of net-work, which retained too much moiſture in the winter, and, by robbing each other of nouriſhment, proved prejudicial to both. If the ſoil of the vineyard was poor, Mago directed that the holes ſhould be filled up with rich earth brought from elſewhere. The ground ſhould be a little moiſt when the vines are planted; but it had better be dry, than mirey wet.

Mr. Miller orders that the ground, which he before directed to be fallowed, be again well plowed in March; and that after having laid its ſurface even, the rows ſhould be marked out, from ſouth-eaſt to north-weſt, at the diſtance of ten feet from each other. He then croſſes theſe rows at the diſtance of five or ſix feet, and thereby marks the ſpot where each plant is to be ſet. The rows will conſequently be, in this caſe, ten feet aſunder, and the diſtance between the vines in each row will be five or ſix feet; nearer than which they ought never to be planted. If they are ſet in ſquares ſo near together as ſix feet, there cannot be room for a ſufficient current of air to paſs between them when their branches are extended on one ſide; and for want of that the damps in autumn will be detained among the vines, to the great prejudice of their fruit. In places abroad, continues he, where they regard the quality of their wine more than the quantity, they never plant their vines at leſs than ten feet, row from row, and ſome allow twelve: and he confirms the juſtneſs of this rule by what happens to other fruits, which are never ſo well coloured, ſo early ripe, or ſo well flavoured, when in cloſe plantations, as when they are produced on trees where the air can circulate freely about them, and the rays of the ſun have free acceſs to the branches, whereby the juices are better prepared.

Preferring cuttings to layers, as well as to rooted vines, he directs, that the cuttings be taken from the vine in the autumn, and that their ends, being made ſmooth, they be laid in the ground, about two inches deep, the reſt of the cutting being left at full length; only obſerving to cover them with dry litter, or peas haulm, in dry froſty weather. In moiſt weather the covering ſhould be taken off, leſt it heat, and make the cuttings grow, which would greatly injure them. In April, which he reckons the beſt ſeaſon for planting vines in England, the cuttings ſhould be taken out of the ground, and their upper parts cut off, ſo as to reduce them to about fourteen inches in length, according to the diſtance of the buds or eyes. He thinks it of great ſervice to leave their tops on all the winter, becauſe the air would otherwiſe penetrate the wounded part, and greatly injure the remaining eyes. The lower ends of the cuttings ſhould be put in water, about three inches deep, ſetting them upright, for ſix or eight hours, before they are planted, in order to moiſten them and open their pores: then, at the center of every croſs mark, before made, a hole

ſhould be dug with a ſpade, about a foot deep, and one ſtrong cutting ſhould be ſet, a little ſloping, in each of theſe holes, which ſhould afterwards be filled up immediately with earth preſſed down gently to the cutting. This earth ſhould be raiſed about three inches round each cutting, ſo as juſt to cover its upper eye or bud, to prevent the wind and ſun from drying it; for only that upper bud will ſhoot when the plant is thus managed.

Mr. Miller juſtly blames his countrymen for planting their vineyards, in the few attempts that have been made of them in England, with ſuch grapes as are the ſweeteſt and beſt for eating; this being contrary to the general practice abroad, where the rough auſtere grapes, which are by no means palatable, but which are by experience found to afford a noble rich wine, are preferred. This is alſo agreeable to the conſtant practice of the makers of cyder, who obſerve, that the beſt eating apples yield but a poor juice, and that the rough ſorts afford a ſtrong vinous liquor. I believe, continues he, that it will be found true in all fruits, that where the natural heat of the ſun ripens and prepares their juices, ſo as to render them palatable; whatever degree of heat theſe juices have more, either by fermentation, or from any other cauſe, will render them weaker, and leſs ſpirituous. Of this we have many inſtances in fruits: for if we tranſplant any of our ſummer or autumn fruits, which ripen perfectly in England without the aſſiſtance of art, into a climate a few degrees warmer, theſe fruits will be mealy and inſipid. So likewiſe, if we bake or ſtew any of theſe fruits, they will be good for little, becauſe they will loſe all their ſpirit and flavour by the additional heat of the fire: and on the other hand, many fruits which are not even eatable whilſt raw, are thereby much improved. Some of theſe, which have been tranſplanted into a warmer climate, have been ſo altered by the greater heat of the ſun, as to excel the very fineſt of the fruits that are ripened in this country. The grape moſt likely to ſucceed in England, is the Auvernat, or true Burgundy grape, which thrives very well in ſeveral places north of Paris.

Columella adviſes every prudent huſbandman to ſtock his vineyards with different ſorts of vines, becauſe the weather is not ſo equal in any year, but that it may be more hurtful to ſome, than to others. If, therefore, he plants but one kind of vine, and the weather happens to be prejudicial to it, he will be deprived of his whole vintage: but if he has vineyards of various ſorts, ſome of them may eſcape, and yield him fruit. He recommends particularly, that each kind of vine be planted by itſelf; becauſe otherwiſe one of the following inconveniencies will enſue; viz. either he muſt gather his late grapes with thoſe that are early ripe, which will cauſe an acidity in the wine; or if he waits till the late fruit come to maturity, the early grapes will be rotten, or deſtroyed by birds or rain: for the diſtinguiſhing of each kind cannot be truſted to the gatherer's diſcretion. The flavour of the ripe grapes is hurt by the addition of the unripe; nor will the wine made of them both, mixed together, keep till it is old. When each ſort is ſeparate, the vine dreſſer will be able to prune and manage it in the moſt proper manner.

He cautions his readers ſtrongly againſt the too prevailing opinion of thoſe who imagine, that the chief care and trouble are at an end when the vineyard is planted. He obſerves, that the vine is a tender delicate ſhrub, which can very ill bear neglect, and which, when young, often deſtroys itſelf, by being permitted to run too much to wood, or to bear too great quantities of fruit. Moſt people are ſo intent on having much fruit that they load the vine with too many bearing branches, without having any regard to future years, or to poſterity; and then complain, that their vineyards do not anſwer their expectation, when they themſelves have deſtroyed them, either through covetouſneſs, negligence, or ignorance. When the vine has arrived at its full ſtrength and maturity, it can better bear ſome neglect. Believe, Silvinus, ſays this excellent huſbandman to his friend, what I know from my own experience, that a vineyard judiciouſly planted with good vines, and well cultivated, never fails to bring its owner a moſt abundant return. This he confirms from Græcinus, by the example of Pavidius Veterenſis, who had two daughters, and a farm planted with vines. He gave the eldeſt daughter one third of his farm, on her marriage, and yet had as much fruit from the remaining two thirds, as he had before from the whole. He afterwards gave half of the remainder to the younger daughter, on her marriage, and ſtill had as good an income as at firſt. This, ſays Columella, muſt ariſe from the remaining thirds being proportionally better cultivated, than the whole had been before.

Mr. Miller ſays, that as the ſpace between the rows of vines is great, the ground there may be ſown or planted with any kind of eſculent plants, provided they are kept at ſuch diſtance from the vines, that theſe be not injured by them. This huſbandry, which is alſo the method in France, may be continued three or four years, till the vines come to bearing: but after that, no ſort of crop ſhould be ſet between them in the ſummer; becauſe, the clearer the ground is kept, the more heat will be reflected to the grapes. After they are gathered, a crop of coleworts, for ſpring uſe, may indeed be planted between the rows, and the ſtirring of the ground for them will be of great ſervice to the vines.

From the time that the vine firſt begins to bud, all ſuperfluous ſhoots muſt be carefully rubbed off, that the nouriſhment may be conſumed by thoſe only which are to be reared. Two ſhoots are generally ſet apart for growth; the one as a reſerve, in caſe the other ſhould fail. As ſoon as they riſe, a prop ſhould be ſet in the ground, for each of them. This prop ſhould be ſlender, becauſe the weak tendrils of the vine will then lay hold of it more eaſily than if it was thick. As the ſhoots grow up, they are tied to the props with a ſoft ſlack binding, till their tendrils have encircled them; and at leſs than four feet from the ground, ſticks are faſtened acroſs the props, that the vines may extend laterally, and thereby be the leſs expoſed to the force of winds. In nurſeries, this croſs ſtick, or rail, ſhould not be above a foot high, leſt ſtrong winds ſhould tear the young plants out of the earth. When the ſhoots are grown nearly to their full height, their tops are broken off, to make them increaſe in thickneſs and ſtrength, rather than run up into a needleſs length. The moſt thriving ſhoot, which is to be the leading wood branch, muſt be trained up ſtrait, and kept clear of ſecondary ſhoots for three feet and a half from the ground: but ſuch as grow above that height may be permitted to remain till the autumnal pruning; for if they are all rubbed off, new ſhoots will immediately ſpring out from other eyes, ſo that, perhaps, none may be left for the next year's buds. The ſhoots which are rubbed off from time to time ſhould never be ſuffered to grow ſo ſtrong, as not to be eaſily diſplaced with the finger; for the heat in ſummer hurts the vine greatly wherever it has been wounded with a knife. For this reaſon, if it ſhould be abſolutely neceſſary to uſe the knife, a piece of the ſhoot which is cut off ſhould be left prominent from the ſtem, to ſtop the effect of the heat, which, in that caſe, will not proceed farther.

During the ſecond year's growth, the ground ſhould be kept conſtantly ſtirred, as in the preceding year, only with this difference, that it may be done once ſeldomer. The weeds muſt be kept under, till the vines, by extending their branches, ſhade the ground, and thereby prevent their growing under them. All ſuperfluous twigs muſt be conſtantly rubbed off as before, and only one ſhoot ſhould be permitted to grow up. The props muſt be continued as in the former year. If any of the plants died in the firſt year, two ſhoots may be reared up on the ſtrongeſt of the vines next the vacant ſpace; one to form the ſtandard ſhoot, and the other to be made a layer, to ſupply the place of the dead vine. After the vintage, this ſhoot muſt be laid down, or if it be not long enough to riſe out of the earth on the other ſide of the hole, only its extremity need be put into the ground, as already directed. Next year, the layer muſt be cut half through, in the bend, that ſo it may not rob its mother too much, but be brought to be nouriſhed by its own roots. When it is two years old, it may be cut

off from the mother plant, and its root muſt be carefully ablaqueated, that it may ſtrike the deeper into the earth. If the neighbouring vines cannot furniſh layers, a rooted vine muſt be brought from the nurſery; for it is too late to recruit a vineyard, when we ſhould be gathering its fruit.

For the third year's growth, the vine muſt be ſupported with ſtronger and higher props than before. Theſe ſhould be fixed, either a foot from the vine, that they may not hurt the roots, and that ſo the vine dreſſer may dig all round the vine; or in the middle between two vines. The firſt way is the beſt, becauſe the vine and prop mutually ſupport each other. If the prop is fixed near the vine, it ſhould ſtand ſo as to ſhelter the vine from the north. It is of great importance that the prop ſtand very firm. On each upright prop muſt be put a croſs pole, ſufficiently ſtrong to bear the weight of the fruit. This year the vine may be permitted to make two ſhoots, to cover the croſs pole on each ſide with bearing branches, unleſs the vine be yet too weak to nouriſh them. All ſuperfluous ſhoots and twigs muſt be carefully rubbed off. The ground muſt be frequently ſtirred, to keep it looſe, and deſtroy weeds. The roots muſt be laid bare in October. The places of dead plants muſt be ſupplied, as directed for the preceding year, and this muſt be a conſtant rule every year. When a vine dies after it has ſtood for ſome years, the hole or trench which is made for the layer or young plant, muſt be dug deeper and wider than it need to be after a young vine, in order that all the roots of the old one may be taken away. The trench ſhould then be partly filled with freſh earth, or a good deal of dung mixed with the former ſoil. If each ſide of the vine has produced two ſhoots, and both of them ſhew plenty of fruit; yet one muſt be taken away, that the other may thrive the better, and bring its fruit to greater perfection.

When this vintage is finiſhed, the vine may be pruned ſo as, in a fertile ſoil, where it thrives well, to leave three eyes, to produce bearing ſhoots for the next year; but four eyes ſhould ſeldom be left. The binder muſt ſeparate theſe ſhoots, and tie them to the frame, to which another croſs pole is now added, in the form of a ſtar: or theſe croſs poles may be ſupported by four props. The ſhoots ſpread in this manner become a counterpoiſe to each other. Theſe croſs frames are the more neceſſary if the vines are expoſed to ſtormy winds, or if they ſtand on ſteep declivities, where every means of propping them is wanted. In warm and dry ſituations, the frame may be extended on all ſides, in the form of an arched roof, the better to ſhade the thirſty earth: but in cold and froſty climates, the vines muſt be ſupported only on ſingle frames or eſpaliers; for then the earth is more eaſily warmed by the ſun, the fruit is more thoroughly ripened, and a freer paſſage is afforded to the air. The frames ſhould not be lower than four feet, nor higher than ſeven. Young vines ſhould be brought to this height gradually. The moiſter the ſoil and climate are, the higher ſhould be the frame; for there, the thriving ſtate of the vines admits of raiſing their branches, and their fruit being thereby raiſed higher from the earth, is the leſs liable to rot. In this ſituation, the winds blow freely through them, and dry up the dews and noxious fogs; the vines bloſſom more kindly, and yield a better wine. On the other hand, vines in a poor ſoil, on a ſteep declivity, and ſubject to ſcorching heat, require lower frames. If the vineyard is well placed, the beſt height is five feet; though there is no doubt but that the wine is the better flavoured, the higher the frames are.

If the vineyard is interſected by foot paths which divide it into a number of ſmall partitions, the ſun and wind have the freer acceſs to the vines; as hath alſo the eye of the maſter, which is of great advantage. The labour too ſeems leſs to the vine-dreſſers, when it is thus portioned out in ſmall diviſions. The paths afford convenient paſſage for the grape gatherers, for thoſe who repair the frames, and for bringing in manures, or what elſe may be wanted. The owner can likewiſe diſtinguiſh the fruitfulneſs of each ſpot, and thereby be enabled to apply proper remedies. Where the rows of vines ſtand very far aſunder, too much ground is generally left uncultivated between them; one half of which is commonly uſed for alleys, or foot-paths.

The trunk of the vine ſhould be carried up ſtrait to within a foot of the top of the frame; not only to conduce to its beauty, but alſo to its fruitfulneſs and duration: for the moiſture which nouriſhes plants never has ſo free a motion through a crooked ſtem, as it has through a ſtrait one; the bendings proving ſo many lets or hinderances to the equal circulation of the ſap. The top of the vine ſhould be faſtened to the prop, ſo as to prevent its being bent, or dragged down, when it is loaded with fruit; and for greater ſecurity in this reſpect, the arms, or branches, which proceed from thence, ſhould be trained along the frame, and tied to it, ſo that only thoſe parts of the ſhoots on which the fruit grows may hang ſloping down from the edge of the frame: nor ſhould this be at right angles from the binding, becauſe that poſition would endanger their breaking. When thus ſituated, they are leſs expoſed to rain and hail, than when they are faſtened to the frame. They ſhould however be tied up before the grapes are ripe, to guard againſt their being rotted by the dew. When the vine is five years old, it will be ſufficient to leave one fruit bearing ſhoot on each of its arms, or branches: but, ſome years after, when it has attained its full ſtrength, a luxuriant vine, in a rich ſoil, may convey nouriſhment to eight fruit-bearing ſhoots; and, indeed, unleſs it be checked by a quantity of fruit, it will waſte itſelf in wood and leaves: whereas a weak vine, in a poor ſoil, will ſoon be exhauſted if it is burthened with fruit.

The branches of a vine ſhould never be ſuffered to grow bigger than the ſtock: but, to ſupply their place, ſhoots iſſuing from their ſides ſhould be trained, and as ſoon as theſe begin to bear fruit, the old hard wood ſhould be cut away. Fewer bearing ſhoots ſhould be left on the branch which extends northward, than on that which is directed toward the ſouth; becauſe this laſt requires the greateſt ſhelter from the ſcorching heat of the ſun, and therefore ſtands moſt in need of leaves. All ſuckers muſt be cut away from the root, and the place whence they ſprung ſmoothed with a knife; for then it will ſoon ſkin over. No ſhoots muſt be ſuffered to grow from the trunk, nor ſhould any knobs or warts be left on it. All dry, cracked, and ſhrivelled bark, muſt be taken off. Moſs likewiſe, which ſhackles the vine, as with a fetter, and ſoaks it with its pernicious moiſture, muſt be carefully ſcraped off: and if the trunk is any way damaged, or rendered hollow by rain or inſects, it muſt be cut away to the ſound wood. The wound ſhould then be covered with earth which has been moiſtened with lees of oil; for this will defend it from inſects, ſun, and rain, and therefore make it heal the ſooner. All broad, ill-ſhaped, withered ſprays, and ſuch as hang downward, commonly called danglers, muſt be cut off; and the ſtrait ſhoots muſt be preſerved. When the vine is freed from all theſe incumbrances, it will thrive the better, and yield the purer wine. The vine dreſſer ſhould be particularly attentive, that all wounds in the ſolid wood be made ſloping and round; becauſe they afford the leaſt lodgment to water, and are the ſooneſt cloſed.

Sometimes a ſtrong ſhoot ſtrikes out of the fork of two of the leading branches, and cripples one of them. In this caſe, the crippled branch muſt be cut off, and the young ſhoot reared in its ſtead: but if it be taken in time, the young ſhoot ſhould be cut off. Whatever grows out of the trunk of the vine muſt be cut away ſo ſmooth, that no water may lodge in the ſcar: but what grows on the young ſhoots of the ſame year, ſhould be cut off between the two firſt eyes; leſt by cutting it too near the main ſhoot, this alſo ſhould be hurt by the wound, and the neighbouring bud be killed.

As to the length of the fruit-bearing ſhoots, there is no general rule; for it may depend greatly on the quality of the ſoil, and the vigour of the vines, as well as on the diſtance between the eyes; for where the joints are ſhorter, a leſs length of ſhoot may be equally loaded with fruit. The laſt year's vintage ſhould alſo be conſidered: for thoſe parts of the vine which then bore great

plenty of fruit, muſt be ſpared in the following year; and ſuch as produced but a ſmall quantity, may be loaded the more. Moſt particular care ſhould be taken, that every cutting inſtrument which touches a vine, be ſharp and well tempered; for otherwiſe, the labour of the vine-dreſſer is greater, and the vine is rather torn than cut; ſo that there then remains an uneven ſcar, in which the juices putrify, ſo as often to kill the vine.

In the autumn, the vines which have produced two ſtrong ſhoots of equal vigour, muſt be cut down to three eyes each. When they have a ſtrong ſhoot and a weak one, the ſtrong ſhoot muſt be ſhortened to three eyes, and the weak one to two: and ſuch as have but one ſtrong ſhoot, ſhould be ſhortened to two eyes.

In March of the third year, two ſtakes ſhould be placed down by the ſide of all ſuch vines as have two ſhoots, at ſuch diſtance on each ſide of the plant, that the ſhoots, faſtened thereto, may form an angle of forty-five degrees, with the ſtem: but they ſhould not by any means be bent down horizontally, as ſome injudiciouſly adviſe and practiſe: for the branches, then lying too near the earth, are generally injured by the damps which ariſe from thence, eſpecially if they have fruit, which is never ſo well taſted, nor ſo ripe, as when they are a little elevated. In May, the ſtrong ſhoots ſhould be faſtened to the ſtakes.

If the two ſhoots of the former year have produced two ſtrong branches, the uppermoſt of theſe ſhoots upon each branch ſhould be ſhortened down to three good eyes, not including the lower eye, which ſeldom produces any thing more than a weak dangling ſhoot; and the lower ſhoot ſhould be ſhortened to two good eyes; theſe being deſigned to yield vigorous ſhoots for the next year, as the former are to bear fruit. Where the vines are weak, and have not produced more than two or three ſhoots in the ſummer, but one of theſe ſhould be left with three eyes, for bearing; the other muſt be ſhortened down to two, or if it be weak, to one good eye, in order to obtain ſtrong ſhoots the following ſummer: for nothing is more injurious to young vines, than leaving too much wood upon then, or over-bearing them.

In March of the fourth year, all ſmall horizontal roots, which may have been produced near the ſurface of the ground, ſhould be cut off cloſe to the trunk. A ſtake ſhould be placed about ſixteen inches from the root, on each ſide of the vine, and the bearing branches ſhould be faſtened thereto. Then another, and taller, ſtake ſhould be thruſt down near the foot of the vine, and to this ſhould be tied the two ſhoots which were pruned down to two eyes. In May the ſhoots which ſhew fruit muſt be faſtened to the ſtakes, with baſs, to prevent their being broken, until they are extended to three joints beyond the fruit; when they ſhould be ſtopped, by nipping off the end: but the ſhoots, which are deſigned for bearing the next year, ſhould be trained upright to the middle ſtake; by which method, neither of them ſhading the other, each will enjoy the benefit of the ſun and air. The ſhoots ſhould be conſtantly kept in their right poſition, to prevent the inverting of their leaves; for when that happens, it greatly retards the growth of the fruit.

Mr. Miller very juſtly cenſures the abſurd practice of thoſe who pull off from their vines the leaves which grow near the fruit, in order to let in the rays of the ſun, to ripen it; not conſidering how much they thereby expoſe their fruit to the cold dews which fall plentifully in autumn, and which, being imbibed by the fruit, greatly retard it: beſides, no fruit will ripen ſo well when it is entirely expoſed to the ſun, as when it is moderately ſcreened with leaves. By pulling off the leaves, which are abſolutely neceſſary to prepare the juices before they enter the fruit, and of which juices the groſs parts are perſpired by them; the fruit muſt either be deprived of nouriſhment, or elſe, ſome of the groſs particles will enter with the more refined parts of the juices, and thereby render the fruit worſe than it would be if the leaves were left upon the branches.

Mr. Miller directs, that the vineyard, being now arrived at a bearing ſtate, ſhould be treated after the folowing manner. Too many branches ſhould never be left upon a root, not ſhould thoſe be too long: for although a management contrary to this may be productive of greater quantity of fruit, yet that fruit will not be ſo well nouriſhed, nor will its juice be ſo good, as when it is but moderately plentiful: neither will the roots of the plants be ſo much weakened in this laſt caſe, as they muſt be in the former. The ground ſhould be conſtantly kept clear of weeds; and no ſort of plant ſhould be ſuffered to grow on it, excepting that which it is intended to cultivate. It ſhould be manured every third year, according to the nature of the ſoil. If the land is ſtiff, and inclinable to bind on the ſurface, ſea-ſand, or ſea-coal aſhes, are very good manure: but if it is looſe and dry, a little lime mixed with dung will do it the moſt ſervice. After each ſpring digging, the ſtakes are fixed as already mentioned, and the ſame care and management of the vines, as was before directed, muſt be continued. Mr. Arnoux ſays, that, in Burgundy, they bind the branches of the vine in an horizontal poſition, at the height of half a foot from the earth, to props three or four feet high, ſtuck into the ground, without any order, at the diſtance of about a foot aſunder. They tie the ſhoots to theſe props as they extend in length, and find in this method the advantage that one branch is not ſhaded by another, but for as little a time as is poſſible.

Columella directs, that the props and frames be carefully examined after every pruning, and that whatever is amiſs in them be repaired. Broad and flat props are preferable to round ones, and oak is the beſt wood they can be made of. Next to them, are round props of juniper, laurel, foreſt pine, and elder. Such as are rotten muſt be taken away, and new ones put in their ſtead. The bindings ſhould be new every year. The ligature which faſtens the ſtem to the prop ſhould not be always in the ſame place, leſt it ſhould occaſion a wound. The four branches ſhould be tied gently to the croſs poles, ſo as not to twiſt or bend them much. The ſhoots ſhould be faſtened ſo as that, when they grow beyond the frame, they may go ſhelving from it, and not hang by their binding, which would be apt to break them, eſpecially when loaded with fruit. When two branches are ſo near together as to go to the ſame ſide of the frame, another pole ſhould be placed between the croſs ones, for one of thoſe branches to be faſtened to.

Thoſe who are curious in gardening know what great things Dr. Agricola boaſts of from the uſe of his mummies, in rearing the tendereſt plants, as well as in raiſing foreſt trees from cuttings. The lees of oil, as Columella directs, mixed with fine earth, to give it a conſiſtence, may probably anſwer the ſame purpoſes. Where lees of oil cannot be had, ſome other bitter vegetable ſubſtance might be contrived, which, being free from the acrid oil in all turpentines (as in Agricola's mummies) might prove very friendly to plants, and be particularly uſeful in preventing their wounds from bleeding, and in preſerving them from being ſcorched by the ſun, or hurt by inſects. It is neceſſary that this ſubſtance be bitter, that it may hinder the inſects from preying on the tender juicy fibres, for inſtance, of the vine, whereever a wound is made. Even loam, by itſelf, is found to be ſerviceable for theſe purpoſes; and ſo is either goat's, ſheep, or cow's dung, well mixed with a due proportion of earth. The vine-dreſſer ſhould therefore conſtantly have ſome ſuch ſubſtance ready to apply to every wound he makes in the vine. Perhaps too, it may prove uſeful to the cuttings, when theſe are planted, by retaining the juices, till they are employed in their office of vegetation, and thereby help to ſave them from being parched up by drought, as well as to render them leſs liable to be ſoaked in a wet ſoil, or by a rainy ſeaſon.

VINEGAR, *Acetum*, an acid penetrating liquor, prepared from wine, cyder, beer, &c. of conſiderable uſe both as a medicine and ſauce.

The proceſs of turning vegetable matters to vinegar, is thus delivered by Dr. Shaw: take the ſkins of raiſins, after they have been uſed in making wine; and pour three or four times their own quantity of boiling water upon them, ſo as to make a thin aqueous mixture. Then

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ſet the containing caſk, looſely covered, in a warmer place than is uſed for vinous fermentation; and the liquor in a few weeks time will become a clear and ſound vinegar; which being drawn off from its ſediment, and preſerved in another caſk, well ſtopped down, will continue perfect, and fit for uſe.

This experiment ſhews us a cheap and ready way of making vinegar from refuſe materials; ſuch as the huſks of grapes, decayed raiſins, the lees of wine, grounds of ale, beer, &c. which are frequently thrown away as uſeleſs. Thus, in many wine countries, the marc, rape, or dry preſſing of grapes are thrown in heaps, and ſuffered to putrify unregarded; though capable of affording as good vinegar, as the wine itſelf. In ſome places they bury copper-plates in theſe huſks, in order to make verdigriſe; but this practice ſeems chiefly confined to the ſouthern parts of France. Our preſent experiment ſhews us how to convert them to another uſe; and the direction extends to all the matters that have once undergone, or are fit to undergo, a vinous fermentation, for that all ſuch matters will afford vinegar. Thus all our ſummer-fruits in England, even black-berries; all the refuſe waſhings of a ſugar-houſe, cyder-preſſings, or the like, will make vinegar, by means of water, the open air, and warmth.

The whole proceſs, whereby this change is effected, deſerves to be attentively conſidered. And, firſt, the liquor to be thus changed, being kept warmer than in vinous fermentation, it, in a few days, begins to grow thick, or turbid; and without throwing up bubbles, or making any conſiderable tumult, as happens in vinous fermentation, depoſits a copious ſediment. The effect of this ſeparation begins to appear firſt on the ſurface of the liquor, which gathers a white ſkin, that daily increaſes in thickneſs, till at length it becomes like leather; and now, if continued longer in this ſtate, the ſkin turns blue, or green, and would at laſt grow ſolid, and putrify: therefore, in keeping down this ſkin as it grows, and thruſting it gently down to the bottom of the veſſel, conſiſts much of the art of vinegar making, eſpecially from malt. For the difference between vinous and acetous fermentation, ſee FERMENTATION.

Method of making Cyder VINEGAR. The cyder, the meaneſt of which will ſerve the purpoſe, is firſt to be drawn off fine into another veſſel, and a quantity of the muſt, or pouz of apples, to be added; the whole is ſet in the ſun, if there be a conveniency for the purpoſe; and, at a week or nine days end, it may be drawn off. See CYDER.

Method of making Beer VINEGAR. Take a middling ſort of beer, indifferently well hopped; into which, when it has worked well, and is grown fine, put ſome rape, or huſks of grapes, uſually brought home for that purpoſe: maſh them together in a tub; then, letting the rape ſettle, draw off the liquid part, put it into a caſk, and ſet it in the ſun as hot as may be; the bung being only covered with a tile, or ſlate ſtone: and in about thirty or forty days it will become a good vinegar, and may paſs in uſe as well as that made of wine, if it be refined, and kept from turning muſty.

Or thus: to every gallon of ſpring water, add three pounds of Malaga raiſins: which put into an earthen jar, and place them where they may have the hotteſt ſun from May till Michaelmas: then, preſſing all well, tun the liquor up in a very ſtrong iron hooped veſſel, to prevent its burſting: it will appear very thick and muddy, when newly preſſed; but will refine in the veſſel, and be as clear as wine. Thus let it remain untouched for three months, before it be drawn off, and it will prove excellent vinegar.

Method of making Wine-VINEGAR.—Any ſort of vinous liquor, being mixed with its own fœces, flowers, or ferment, and its tartar, firſt reduced to powder; or elſe with the acid and auſtere ſtalks of the vegetable from whence the wine was obtained, which hold a large proportion of tartar: and the whole being kept frequently ſtirring in a veſſel which has formerly held vinegar, or ſet in a warm place full of the ſteams of the ſame, will begin to ferment a-new, conceive heat, grow ſour by degrees, and ſoon after turn into vinegar.

The remote ſubjects of acetous fermentation are the ſame with thoſe of vinous; but the immediate ſubjects of it are all kinds of vegetable juices, after they have once undergone that fermentation which reduces them to wine: for it is abſolutely impoſſible to make vinegar of muſt, the crude juice of grapes, or other ripe fruits, without the previous aſſiſtance of vinous fermentation.

The proper ferments for this operation, whereby vinegar is prepared, are, 1. The fœces of all acid wines. 2. The lees of vinegar. 3. Pulverized tartar; eſpecially that of Rheniſh wine, or the cream or cryſtals thereof. 4. Vinegar itſelf. 5. A wooden veſſel, well drenched with vinegar, or one that has been long employed to contain it. 6. Wine that has often been mixed with its own fœces. 7. The twigs of vines, and the ſtalks of grapes, currants, cherries, or other vegetables of an acid auſtere taſte. 8. Bakers-leaven, after it is turned acid. 9. All manner of ferments, compounded of thoſe already mentioned.

The French uſe a method of making vinegar different from that above deſcribed. They take two very large oaken veſſels, the larger the better, open at the top; in each of which they place a wooden grate, within a foot of the bottom: upon theſe grates, they firſt lay twigs, or cuttings of vines, and afterwards the ſtalks of the branches, without the grapes themſelves, or their ſtones; till the whole pile reaches within a foot of the brim of the veſſels: then they fill one of theſe veſſels with wine to the very top, and half fill the other; and with liquor drawn out of the full veſſel, fill up that which was only half full before; daily repeating the ſame operation, and pouring the liquor back from one veſſel to the other; ſo that each of them is full, and half full, by turns. When this proceſs has been continued for two or three days, a degree of heat will ariſe in the veſſel, which is then but half full, and increaſe for ſeveral days ſucceſſively, without any appearance of the like in the veſſel which happens to be full, during thoſe days; the liquor of which will ſtill remain cool: and as ſoon as the heat ceaſes in the veſſel that is half full, the vinegar is prepared: which, in the ſummer, happens on the fourteenth or fifteenth day from the beginning; but in the winter, the fermentation proceeds much ſlower: ſo that they are obliged to forward it by artificial warmth, or the uſe of ſtoves.

When the weather is exceeding hot, the liquor ought to be poured off from the full veſſel into the other twice a day: otherwiſe, the liquor would be overheated, and the fermentation prove too ſtrong; whence the ſpirituous parts would fly away, and leave a vapid wine, inſtead of vinegar, behind.

The full veſſel is always to be left open at the top, but the mouth of the other muſt be cloſed with a cover of wood, in order the better to keep down and fix the ſpirit in the body of the liquor; for otherwiſe, it might eaſily fly off in the heat of fermentation. The veſſel that is only half full ſeems to grow hot, rather than the other, becauſe it contains a much greater quantity of the vine twigs and ſtalks, than that, in proportion to the liquor; above which the pile, riſing to a conſiderable height, conceives heat the more, and ſo conveys it to the wine below.

Vinegar is not a pure or ſimple acid, like thoſe of the mineral kingdom: the vapidity and putrefaction to which it is ſubject, and its chemical analyſis, diſcover, that it participates largely of an oily matter. Diſtilled by a moderate heat, not exceeding that of boiling water, it yields firſt a phlegmatic liquor, afterwards a ſlightly acid one, which is ſucceeded by ſtronger and ſtronger acids, till the matter in the diſtilling veſſel becomes thick and unctuous like honey: the vinegar prepared from malt liquors contains more of this viſcous ſubſtance than that of wine, and hence is more diſpoſed to become ropy and ſlimy in keeping. This reſiduum, urged with a ſtronger fire, gives over an empyreumatic oil, and a penetrating acid ſpirit tainted with the ill ſmell and yellow colour of the oil. There now remains a black coal, which, burnt into white aſhes, yields a conſiderable proportion of fixed alcaline ſalt.

Pure fixed alcaline ſalt, ſaturated with the colourleſs diſtilled liquors, and afterwards exſiccated, contracts a yellowiſh

yellowiſh or brown tinge; and thus betrays, that the acid ſtill retains a portion of the oil. On gently melting the dry ſalt, the oily matter burns to a black coal, which ſeparates on diſſolution in water: the ſolution exhaled to dryneſs, leaves a perfectly white neutral ſalt, containing the pure acetous acid combined with the alcali. On adding to this compound a little oil of vitriol, the acetous acid is diſengaged, and may now be collected by diſtillation, in a highly concentrated ſtate, and of a very pungent volatile ſmell.

The quantity of fixed alcaline ſalt, which vinegar is capable of ſaturating, is one of the ſureſt criterions of its ſtrength. The beſt of the German vinegars, according to Stahl, ſaturate little more than one fortieth of their own weight; the French vinegars, examined by Geoffroy, above one thirty-fifth, and ſome of them no leſs than one twelfth; the common diſtilled vinegar of our ſhops, about one twentieth. By congelation, and diſtillation from alcalies and other bodies, the acid may be ſo far concentrated as to ſaturate near equal its own weight; a greater degree of ſtrength, than even the mineral acid ſpirit of ſea-ſalt can eaſily be brought to.

The acetous acid, however purified or concentrated, differs eſſentially from all the others: from the native vegetable acids, in ſubtility and volatility; nor being obtainable in the form of a concrete ſalt, which moſt, perhaps all, of the native ones are; and riſing in diſtillation with a moderate heat, which none of the native ones have been found to do; the acid juices giving over, in the heat of boiling water, only their aqueous fluid, and having greateſt part of their acidity deſtroyed by a ſtronger heat: from the mineral acids, in its habitude to different bodies, and the nature of the compounds which it forms with them: thus, whatever alcaline, earthy, or metallic ſubſtance, the acetous acid be combined with, the addition of any mineral acid will disjoin them, the mineral taking the place of the acetous: neutral ſalts, compoſed of the acetous acid and fixed alcalies, diſſolve, totally and plentifully, in rectified ſpirit of wine, whilſt thoſe, compoſed of the ſame alcalies and mineral acids, are not at all ſoluble in that menſtruum: in this property, the acetous acid differs alſo from moſt, perhaps from all, of the acids of its own kingdom:—and from all acids in general, in its peculiar odour.

Vinegar diſſolves the elixated aſhes of vegetables; animal earths, purified by incineration, or when naturally blended with but little gelatinous matter, as in ſhells; the earth of alum; and the mineral calcareous earths. The ſolubility of calcareous earth in the acetous acid, and its precipitability by that of vitriol, afford a ready method of diſcovering the ſophiſtication of vinegar, ſaid to be ſometimes practiſed, with vitriolic acid; and likewiſe of purifying it when ſo ſophiſticated. If a ſaturated ſolution of any calcareous earth, as chalk, made in ſtrong vinegar, be added to ſuch as is ſuſpected of containing vitriolic acid, no change will enſue if the vinegar was pure; but if it contained even a minute portion of that acid, the mixture will immediately become milky, and on ſtanding for a little time depoſite a white ſediment: if the calcareous ſolution be gradually dropt in, ſo long as it produces any milkineſs or cloudineſs, all the vitriolic acid will be abſorbed by, and precipitate with the chalk.

It diſſolves, among metallic bodies, zinc, iron, copper, tin, lead, biſmuth, and regulus of antimony; the two laſt in very ſmall quantity, but ſufficient to give a ſtrong impregnation to the vinegar. It diſſolves lead more eaſily when reduced into a calx, than in its metallic ſtate: boiled even with the glaſs of lead, or in the common glazed earthen veſſels, in the glazing of which, this metal is a principal ingredient, it extracts ſo much as to become ſtrongly tainted with the pernicious qualities of the lead.

It diſſolves the vegetable inſpiſſated juices, and ſeveral of the gummy reſins, and extracts the virtues of ſun dry plants in tolerable perfection; but at the ſame time its acidity makes a notable alteration in them, or ſuperadds a virtue of a different kind. Some drugs however, for particular purpoſes, it excellently aſſiſts or coincides with, as garlic, ſquills, ammoniacum: and in many caſes, where this acid itſelf is principally depended on; it may be advantageouſly impregnated with the flavour of certain vegetables: moſt of the odoriferous flowers impart to it their fragrance; and the blue, bright red, and ſome others, tinge it at the ſame time of a fine purpliſh or red colour.

It mingles equally with blood and its ſerum, and with moſt of the fluids of animals; not thickening or coagulating them, like the acids of the mineral kingdom; but tending rather, as Boerhaave juſtly obſerves, to attenuate and reſolve coagulations. It is likewiſe, when taken internally, leſs ſtimulating than the mineral acids, and leſs diſpoſed to affect the kidnies.

This mild unctuous acid is a medicine of great uſe in the different kinds of inflammatory and putrid diſtempers, both internal and external. It is one of the moſt certain antiphlogiſtics and ſudorifics in high fevers, and one of the beſt preſervatives againſt peſtilential and other putredinous contagions. Fainting, vomiting, lethargic and hyſteric paroxyſms, are likewiſe frequently relieved, by vinegar, applied to the mouth and noſe, or received into the ſtomach: lethargic perſons are often found to be excited more effectually by vinegar blown into the noſe, than by the far more pungent volatile ſpirits. Boerhaave obſerves, that this acid counteracts, in a peculiar manner, the effects of ſpirituous liquors.

The daily uſe of vinegar, with food, is ſalutary in hot bilious diſpoſitions, and wherever there is a tendency to inflammation or putrefaction. It is prejudicial to children, to aged, hyſterical, and hypochondriacal perſons, in cold pale phlegmatic habits, where the veſſels are lax, the circulation languid, and the power of digeſtion weak. It tends in all caſes, if uſed freely, to prevent corpulence; Hoffmann ſuſpects that it produces this effect by impeding the formation of chyle, or deſtroying the union of the unctuous and ſerous fluids of which chyle is compoſed; an effect common to all acids, as appears from their coagulating milk and artificial emulſions. Great corpulence have been reduced by the liberal uſe of vinegar, the acid commonly employed for this purpoſe, but not with impunity; diſeaſes ſucceeding, which eluded the power of medicines, and proved at length fatal.

Combinations of vinegar with different earthy bodies differ in virtue according to the nature of the earth. A ſolution of the aluminous earth in this acid is ſtrongly ſtyptic; of vegetable earths, or magneſia alba, bitteriſh and gently purgative: both theſe ſolutions are milder, and leſs ungrateful, than thoſe of the ſame earths made in the mineral acids, and though as yet unknown in practice, certainly deſerve to be introduced. Solutions of different animal and the calcareous mineral earths are bitteriſh and ſubauſtere, in various degrees; and ſuppoſed to act as mild reſolvents, ſubaſtringents, or diaphoretics.

Combinations of vinegar with fixt alcaline ſalts, are uſeful aperients, diuretics, and cathartics. Two drams of the alcali, diſſolved in as much vinegar as is ſufficient to ſaturate it, will occaſion ten or twelve copious watery ſtools, and a plentiful diſcharge of urine, without griping or fatiguing the patient. Mixtures of alcali and diſtilled vinegar, evaporated to a dry ſalt, are kept in the ſhops; either in a browniſh oily ſtate, as obtained by ſimple evaporation; or purified to perfect whiteneſs, by gentle fuſion and ſolution in water: theſe preparations are given in doſes of ten or twenty grains as mild aperients, and to a dram or two as purgatives and diuretics.

It is ſomewhat difficult to hit the exact point of ſaturation between the acid and the alcali. After fourteen parts of ſtrong diſtilled vinegar have been gradually poured upon one part of the ſalt, the addition of a little more of the acid will occaſion no further effervеſcence while the mixture is cold; but if well heated and ſtirred the effervеſcence begins again, and continues till four or five parts of freſh acid have been added: on exhaling the aqueous fluid, the remaining dry ſalt will generally ſtill raiſe an effervеſcence with freſh vinegar, and require two or three parts more of the acid to render it completely neutral. There is therefore, this advantage, in reducing the ſalt to a dry form, that the perfect neutralization can be obtained with greater certainty than when the ingredients are barely mixed together. The purifi-

cation of the dry ſalt, or ſeparation of its oil, renders it fitter for weak ſtomachs, on which it would not ſit ſo eaſily in its impure ſtate; though the medicine, thus purified, is in ſome particular caſes leſs to be depended upon than the oily ſalt.

Combinations of vinegar with volatile alcaline ſalts, commonly made with diſtilled vinegar added gradually to the ſalt till the effervеſcence ceaſes, have little purgative virtue, but operate powerfully as aperients; by urine if the patient walks about in the cool air, by perſpiration or ſweat, if kept warm in bed. They are principally made uſe of in this laſt intention: and as they act without any ſenſible irritation, they have place in inflammatory caſes, where the warm ſudorifics, if they fail of exciting a ſweat, aggravate the diſtemper. The common doſe of theſe ſolutions is half an ounce.

There are alſo medicated vinegars, as vinegar of antimony, of elder, litharge, roſes, ſquills, treacle, &c. which derive their chief virtues from vinegar.

VINEYARD, a plantation of vines. See VINE.

VINI *Oleum*, *oil of wine*, a very precious liquid, kept as a ſecret in the hands of ſome dealers in ſpirits, and uſed to give the brandy flavour to ſpirits of leſs price. It is certain, that all the ſpirits we uſe take their flavour from the eſſential oil of the ſubſtance they are made from; that of malt is very nauſeous and offenſive, and renders the ſpirit horribly diſagreeable, if not carefully kept back in the diſtillation of it; that of the grape, on the other hand, is extremely agreeable, and is what gives the delicious flavour to French brandy; this, therefore, is to be carefully brought over among the ſpirit in diſtillation.

This is that oil of wine ſo much celebrated among our diſtillers, and is for their uſe made ſeparate, being of ſuch effect, that half an ounce of it will determine a pure and clear malt ſpirit to be French brandy, ſo as to ſtand the teſt of the niceſt palate, and all the trials that can be invented, provided the oil and the ſpirit have both been carefully made.

The manner of making the oil is this: they take the cakes of dry wine lees, ſuch as are uſed by our hatters, and diſſolving them in ſix or eight times their weight of water, they diſtil the liquor with a ſlow fire, and ſeparate the oil by the ſeparating glaſs, reſerving for this nice uſe only that which comes over firſt, the oil that follows being coarſer and more reſinous. To render this buſineſs perfectly ſucceſsful, there muſt be ſeveral things obſerved: Firſt, the lee muſt be of the right kind, that is, of the ſame nature with the French brandy propoſed to be imitated. Secondly, The malt ſpirit muſt be extremely pure. Thirdly, the doſe of the oil muſt be very well proportioned: and, fourthly, the whole muſt be artificially united into one ſimple and homogene liquor. Theſe cautions all regard only the taſte; and beſides theſe, in order to come up to a nice counterfeit, ſeveral other particulars muſt be attended to; ſuch as the colour, proof, tenacity, ſoftneſs, and the like; ſo that, in ſhort, the operation has too much nicety in it to be hit off by every ordinary dealer. When this fine oil of wine is procured, it may be mixed into a quinteſſence, with pure diſtilled alcohol, or the totally inflammable ſpirit of wine, to prevent its growing diſtaſteful, rancid, or reſinous; and thus it may be long preſerved in full poſſeſſion of its flavour and virtues.

The ſtill bottoms, or remaining matter after the diſtillation of this oil, will yield many productions to advantage, particularly tartar, and ſalt of tartar, as alſo an empyreumatic oil, and a volatile ſalt, like that of animals. Some kinds of lees afford all theſe in much greater quantity than others; the lees of canary and mountain wines yield very little of them, and, indeed, ſcarce any tartar or fixed ſalt at all; but the white French lees of thoſe thin wines, that afford the ordinary brandies, yield them all very copiouſly, inſomuch that ſometimes a ſingle hogſhead of dry and cloſe-preſſed lees will afford, by this proceſs, three gallons of this oil, forty pounds of clean tartar, a large proportion of empyreumatic oil, and volatile ſalt, beſides full four pounds of good ſalt of tartar. It is not to be expected, however, that every parcel of this lee ſhould yield fully in this proportion. *Shaw's Eſſay on Diſtillery.*

VINOUS, *Vinoſus*, ſomething that relates to wine, or has the taſte and ſmell thereof.

All vegetables, by a due treatment, afford a vinous liquor; as corn, pulſe, nuts, apples, grapes, &c.

All ſorts of vinous and fermented liquors, both before and after the fermentation, conſiſt not of ſimilar, but heterogeneous parts, which are joined together in one certain and determinate order; thus, the action of fermentation being a ſeparation and deſtruction of the former connection of the ſubject, and tranſpoſing its parts anew, there muſt of neceſſity have been a kind of firm or durable texture in the ſubject ſo diſjoined, ſeparated, and new ranged. For example:

Grapes laid up on dry ſtraw, in a cold place, will, for ſome time after they are ſeparated from the vine, preſerve that texture which gives them their ſaline, unctuous, and ſlimy ſweetneſs; which the juice alſo retains after preſſing, and becomes a clear and tranſparent muſt, without ſeparating itſelf into parts, but continuing regularly and uniformly mixed, ſo as to preſerve the different matters it conſiſts of intimately connected among themſelves. In this firmly connected ſtate they may be kept many months, if a caſk be filled with this juice, and ſet in a cool place, as we evidently ſee in ſtum. *Shaw's Eſſay on concentrating Wines.*

Wine, in the preciſe chemical or philoſophical notion of it, is a ſaline, clammy, oleaginous matter, diluted with a large proportion of water, whereby it is expended, or ſet at diſtance from itſelf, while the ſaline parts are ſaturated with and interſperſed among the ſubtile earthy ones that make the ſlimineſs; thus, they together imbibe, detain, and hold the groſſer parts; beſides which there are other oily parts vaſtly more ſubtile, which, by means of the highly attenuated ſaline portion adhering cloſely to them, remain as much connected with the water as the reſt; and theſe are what we call the ſpirituous parts; but the connection of them all together is ſo ſtrong and durable, that they move for a long time as one body, without ſeparating, if carefully preſerved. An acquaintance with the true nature, hiſtory, and effect of vinous fermentation, will fully explain and juſtify theſe poſitions.

If the ſpirituous part be once ſeparated and drawn away from the wine by diſtillation, though it were immediately to be returned back to the remaining maſs from whence it came, and ever ſo well ſhook again with it, the whole by no means retains its former taſte, odour, and durability, but turns to a confuſed turbid mixture, of a different and nauſeous taſte, and a diſagreeable ſmell; and, on the whole, approaches nearly to a ſtate of vapidity.

The only objection to this general rule is, that if a new fermentation, or even but a fret be raiſed, when the ſpirit is newly joined to the remainder in the ſtill, the ſpirit may be thus reinſtated, and the wine rendered perfect. The proceſs is difficult and uncertain; but a nice management, and a proper intermedium, will bring it about.

If an inflammable ſpirit diſtilled from the ſame, or any other wine, be put to a parcel of wine which is too ſaline, or not ſufficiently ſpirituous, the bare addition, or tumultuous admixture thereof, very far from giving the fine and intimate ſoftneſs of a good wine, will rather manifeſt its own burning acrimony and nidorous flavour to the ſmell and taſte, and will add a nauſeous bitterneſs to the former tartneſs or acidity. This is an obſervation of Stahl's, and is allowed by Dr. Shaw to be true in general; but he obſerves, that, under a nice and proper management, a fine and taſteleſs ſpirit may be prepared and introduced into wines, and will, after a time, become intimately mixed with their other part, and remain abſolutely undiſcoverable to the taſte or ſmell, unleſs by the excellency and the ſtrength it gives. *Stahl's Schediaſma de Concentrat. Vini.*

VINTAGE, a crop of wine, or what is got from the vines each ſeaſon.

The word is alſo uſed for the time or ſeaſon of gathering or preſſing the grapes.

VINUM, a liquor or drink commonly called wine. See WINE.

VINUM, in medicine, *vinum medicatum*, is particularly applied to ſeveral medicated wines, that is, medicinal preparations, of which wine is the baſis. The original intention of medicated wines, was for exhilarating medicines, which were to be continued for a length of time in the moſt familiar and agreeable form: by this means a courſe of remedies was complied with, notwithſtanding the repugnance and averſion which the ſick often manifeſt to thoſe directly furniſhed from the ſhops; and hence the inferior ſort of people had their medicated ales. Nevertheleſs, as vinous liquors are excellent for extracting the virtues of ſeveral ſimples, and are not fitted for keeping, they have been employed as officinal menſtrua alſo; and ſubſtances of the greateſt efficacy are truſted in this form. The moſt noted of theſe medicated wines to be met with in diſpenſatories, are the vinum aleoticum, or alcaline, aleotic wine: vinum amarum, or bitter wine; vinum antimoniale, or antimonial wine: vinum aromaticum, or aromatic wine: vinum chalybeatum, ſteel wine: vinum emeticum, emetic wine: vinum croceum, ſaffron wine; vinum guaiacum, guaiacum wine: vinum ipecacoanhæ, wine of ipecacoanha: vinum millepedatum, wine of millepedes: vinum Peruvianum, wine of Peruvian bark; vinum ſcorbuticum, ſcorbutic wine: and vinum viperinum, viper wine.

VIOL, *Viola*, a muſical inſtrument of the ſame form with the violin, and ſtruck like that with a bow.

There are viols of divers kinds; the firſt, and principal, among us, is the baſs-viol, called by the Italians, viola-digamba, or the leg-viol, becauſe held between the legs. It is the largeſt of all, and is mounted with ſix ſtrings: its neck is divided in half notes by ſeven frets fixed thereon; its ſound is very deep, ſoft, and agreeable.

The tablature, or muſic for the baſs-viol, is laid down on ſix lines or rules. What the Italians call alto viola, is the counter-tenor of this; and their tenore viola, the tenor. They ſometimes call it ſimply the viol: ſome authors will have it the lyra, others the cithara, others the chelys, and others the teſtudo of the ancients.

2. The love-viol, viola d'amore, which is a kind of triple viol, or violin, having ſix braſs or ſteel ſtrings, like thoſe of the harpſichord, ordinarily played with a bow. This yields a kind of ſilver ſound, which is very agreeable.

3. A large viol with forty-four ſtrings, called by the Italians, viola di bardone, but little known among us.

4. Viola baſtarda, or baſtard-viol of the Italians: not uſed among us. Broſſard takes it to be a kind of baſs-viol, mounted with ſix or ſeven ſtrings, and tuned as the common one.

5. What the Italians call viola di braccio, arm-viol, or ſimply, braccio, arm, is an inſtrument anſwering to our counter-tenor, treble, and fifth violin.

6. Their viola prima, or firſt viol, is really our counter-tenor violin; at leaſt, they commonly uſe the cliff C *ſol ut* on the firſt line, to denote the piece intended for this inſtrument.

7. Viola ſecunda, is much the ſame with our tenor-violin, having the cliff of C *ſol ut* on the ſecond line.

8. Viola terza, is nearly our fifth violin, the cliff C *ſol ut* on the third line.

9. Viola quarta, or fourth viol, is not known in England or France, though we frequently find it mentioned in the Italian compoſition; the cliff on the fourth line.

Laſtly, their violetta, or little viol, is in reality our triple-viol, though ſtrangers frequently confound the term with what has been ſaid of the viola prima, ſecunda, &c. See VIOLIN.

VIOL, is alſo a term uſed among mariners, when a hawſer, or ſtrand-rope, is bound faſt with nippers to the cable, and brought to the jeer-capſtan, for the better weighing of the anchor when the main-capſtan proves inſufficient.

VIOLA, the violet, in botany. See VIOLET.

VIOLATION, the act of violating; that is, forcing a woman, or committing a rape upon her.

This term is alſo uſed, in a moral ſenſe, for a breach or infringement of a law, ordinance, or the like; and it is alſo uſed for profanation. See the articles RAPE, &c.

VIOLENT, in the ſchools, a thing done by force; in which ſenſe it ſtands oppoſed to ſpontaneous. See SPONTANEOUS.

A thing is ſaid to be violent when effected by ſome external principle, the body that undergoes it contributing nothing thereto, but ſtruggling againſt it. The ſchoolmen allow, that man, as being endued with reaſon, is capable of ſuffering ſuch violence, but brute and inanimate bodies are not. See the articles INANIMATE, &c.

VIOLET, *Viola*, in botany, a genus of plants, whoſe flower conſiſts of five ringent irregular petals, with a corniculated nectarium at the baſe; the ſtamina are five ſmall filaments, topped with obtuſe antheræ, which are ſometimes connected: the fruit is an ovate trigonal obtuſe capſule, having one cell, which contains many ovate ſeeds.

The common ſweet-ſcented violet is ſo well known as to need no deſcription; it grows in gardens, in woods, and under hedges, in many parts of England, and is eaſily increaſed by parting the roots.

The leaves and flowers are uſed in medicine, and ſometimes the roots; the flowers are a little purgative, and the ſyrup made of them is common, which, when well managed, is of a beautiful colour, and an uſeful laxative for children.

VIOLIN, or FIDDLE, a muſical inſtrument mounted with four ſtrings, or guts, and ſtruck or played with a bow.

The violin, like moſt other inſtruments, conſiſts of three parts, the neck, the table, and the ſound-board. At the ſides are two apertures, and ſometimes a third is added towards the top, ſhaped like a heart. Its bridge, which is below the apertures, bears up the ſtrings which are faſtened to the two exremes of the inſtrument, at one end of them to a ſcrew, which ſtretches or looſens them at pleaſure.

The ſtyle and ſound of the violin is the gayeſt, moſt lively, and ſprightly, of all other inſtruments; and hence it is, of all others, the fitteſt for dancing: yet there are ways of touching it which render it grave, ſoft and languiſhing, and fit for church or chamber muſic. It generally makes the treble or higheſt parts in concerts. It is tuned by fifths: its play is compoſed of baſs, counter-tenor, tenor, and treble: each part has four-fifths, which riſe to a greater ſeventeenth. See the article FIFTH, &c.

In compoſitions of muſic the violin is denoted by V; two V V denote two violins. The word violin, alone, ſtands for treble violin. When the Italians prefix alto, tenore, or baſſo, it then expreſſes the counter-tenor, tenor, or baſs violin. In compoſitions, where there are two, three, or more different violins, they make uſe of primo, ſecundo, terzo, or of the characters I°, II°, III°, or 1°, 2°, 3°, &c. to denote the difference.

The violin has only four ſtrings, each of a different thickneſs; the ſmalleſt whereof makes the *e ſi mi* of the higheſt octave of the organ; the ſecond, a fifth below the firſt, makes the *a mi la*; the third, a fifth below the ſecond, is *d la re*; laſtly, the fourth, a fifth below the third, is *ge re ſol*. Moſt nations ordinarily uſe the cliff *ge re ſol* on the ſecond line, to denote the muſic for the violin only. In France they uſe the ſame cliff as the firſt line at bottom. The firſt of theſe methods is beſt where the ſong goes very low; the ſecond, where it goes very high.

VIOLONCELLO of the Italians is properly our fifth violin; which is a little baſs-violin, half the ſize of the common baſs-violin, and its ſtrings juſt half as thick and half as long, which renders the ſound juſt an octave higher than the ſame.

VIOLONE, in muſic, a double baſs, almoſt twice as big as the common baſs-violin, and the ſtrings bigger and longer in proportion, and conſequently its ſound an octave lower than that of our baſs-violin, which has a noble effect in great concerts.

VIPER, a ſpecies of ſerpent, common to moſt parts of the world. This is by far the moſt noxious animal of the ſerpent kind, that our part of the world affords; and it is as much the moſt uſeful in medicine. Indeed,

ballancing

ballancing the good we receive from it, and the miſchief known to be done by it, it ſeems far more our intereſt that ſuch a creature ſhould be among us.

The viper is a ſerpent uſually between two and three feet in length, when at its full growth, and about an inch or uſually leſs in thickneſs. The colour in the male is generally more brown and duſky than in the female; but, in both, there runs down the whole back, from the head to the tail, an undulated and broad black line; this is properly a chain of black ſpots, of a rhomboidal figure, inſerted into each other at the ends; and by their prominent angles, and the depreſſions between, forming the indented line that terminates the edge of the row of figures ſideways. A little below this broad line, there is on each ſide a ſeries of black ſpots diſpoſed regularly along; and below theſe, near the belly, there is on each ſide a line of ſmall whitiſh ſpots, and another of larger and blackiſh ones; and, finally, under this there is ſtill another row of ſmall white ſpots. The belly is covered with long and narrow black ſcales placed tranſverſely; the tail is not ſo long as in many other ſerpents; it is not carried to more than one fifth part of the length of the body beyond the anus, and it terminates in an extremely ſharp point. This ſmallneſs of the tail is one of the moſt obvious characters of the viper; the colours are not perfectly certain or regular; the belly indeed in all vipers is black, and the diſtribution of the lines and ſpots, where they are any thing diſtinct, is always as juſt mentioned; but the intermediate colour of the body, which may be called the general colour, is very variable; in ſome it is of a pale brown, in ſome an iron colour; in ſome it has a faint caſt of yellow, in ſome of green, and in others of a pale whitiſh. Some vipers have the general colour ſo near that of the variegations, that they are ſcarce diſtinguiſhable; and there have ſome been met with abſolutely black, but theſe are more rare. The poiſon of the viper is ſituated wholly in its mouth, in which, beſide the common rows of teeth, each viper, as well male as female, has on each ſide a phang or long dens caninus, which is hollowed at the baſe, and has about the root a bag of poiſonous liquor, ſecreted from a peculiar gland deſtined to that purpoſe, and opening by a duct into the bottom of the bag. When the creature inflicts a wound, it is with theſe long teeth, and there is always diſcharged into it a quantity of the poiſonous juice, ſecreted for that purpoſe in the bag juſt mentioned. The eyes of the viper are ſmall, and its tongue forked; it darts this out with great violence, when provoked.

The viper is of the number of viviparous ſerpents, according to the common diſtinction, not laying its eggs in a dunghil or other warm places, as the common ſerpent and moſt others do, but retaining them in its body till hatched, and excluding the living young ones. Its food is principally of the animal kind; there are authors who ſpeak of its eating herbs, but on diſſecting vipers, there are generally found in their ſtomach the wings of beetles, the leg bones of mice, and ſometimes whole mice, frogs, and other animals of the like ſize; which, conſidering the natural ſmallneſs not only of the throat, but of the whole neck of the viper, it is amazing to conceive in what manner it goes down. The method indeed is by ſuction, and is very ſlow; the creature's body being drawn out into the utmoſt poſſible thinneſs, and the viper's neck diſtending gradually at the ſame time, till between both it is managed. What greatly facilitates this to the viper and to all the ſerpent kind, for it is common to them all, is, that there is no danger of ſuffocation for want of breath from it, though the whole cavity of the throat be filled up; for, tho' theſe creatures have lungs and reſpiration, yet, it is not of the nature of ours, or of that of quadrupeds; they are not under a neceſſity of taking in and diſcharging a quantity of air, at quick intervals, as we are; but what they have once taken in they retain a long while, ſo that they are under no neceſſity of breathing during this operation, which is therefore not painful to them, as we might naturally imagine, but pleaſant.

It is not eaſy to ſee the viper thus employed, becauſe, after taken, it will ſcarce be brought to eat at all; we have indeed no inſtance of any thing of the ſerpent kind eating while in confinement, except a female viper big with young; and, if poſſeſſed of ſuch a one, it may be poſſible to be a witneſs to it, and to the ſtrange terror of any little animal proper for its preying on, on being thrown in its way. Whoever has an opportunity of throwing a mouſe to a viper in this condition, will ſee how much foundation there is for the ſtories of the rattleſnake, and other ſerpents enchanting, as it is called, the creatures they are to prey upon, in their mouths.

The viper is common in England, but much more ſo in the warmer countries, and there more miſchievous. We may find vipers in the heat of the day, on the dry banks under hedges expoſed to the ſun, and in places not too much frequented almoſt at any time in the hotter months: in winter they retire into holes, and lie torpid the whole cold ſeaſon.—However miſchievous the bite of the viper is, its fleſh is ſafe and wholeſome; indeed, there is no part of it will do any harm, except the poiſon lodged in the wound made by the bite; this very poiſon ſeparated from the bag, diluted with any liquor and ſwallowed, not being capable of producing any bad conſequence.

The bite is attended with very terrible ſymptoms, and in the hotter countries is often fatal; with us many have eſcaped with life, without the aſſiſtance of medicines, ſome in ſpite of bad management; we have lately had the famous remedy of the people who deal in them, and muſt be often bit by them, explained to us. It is no more than common oil, which is to be rubbed on the wounded part over ſome hot coals, and repeated occaſionally. With the aſſiſtance of this we have ſeen people eſcape after very terrible ſymptoms, ſuch as perhaps we have not had an opportunity of ſeeing any body under, who did not uſe the ſame means for relief. Other more painful methods have been preſcribed, but they are now wholly out of uſe. Theſe were the making ſtrong ligatures on the limb above the wound, then ſcarifying and burning it with a hot iron, or making a large inciſion, and filling it with gun-powder, and ſetting them on fire.

Vipers are beſt taken for medicinal uſe in the months of July and Auguſt; they are then moſt vigorous and fatteſt, though thoſe which are taken in ſpring, as ſoon as they come out of their winter's torpid ſtate, are always found to be in very good caſe: they are beſt for uſe, when firſt taken; but the people who ſell them will never tell the truth on this head. They keep them alive in large cheſts, in which they will live a year or more without eating any thing.

Vipers are to be choſen large and vigorous; if intended for uſe while freſh, they ſhould be killed immediately before the time, for their fleſh corrupts very ſoon. If for drying, they ſhould be killed at home, and after ſkinning hung up. Thoſe who buy them ready dried, often have common ſnakes inſtead of vipers, and frequently ſuch as have died of themſelves in confinement.

Vipers diſtilled in a retort yield firſt a moderate quantity of a limpid phlegm, inſipid, and with very little ſmell; after this comes over a phlegm loaded with volatile ſalt, a ſmall quantity of a black and extremely fœtid oil; a large quantity of a volatile ſalt in the mean time concreting and fixing itſelf in a dry form to the ſides of the receiver.

The antients were very well acquainted with the viper; they called it echis and echidna; they had many fanciful and fooliſh ſtories about it, one of which was, that the young ones always deſtroyed the parent animal by gnawing their way out of her body; and this is believed by many to this day, though without the leaſt foundation in truth. They imagined alſo that it fed on ſcorpions, cantharides, and other fatal and poiſonous animals, and that by that means its own poiſon became ſo very fatal.

Many of the ancients, notwithſtanding all the miſchief they dreaded from the viper, eſteemed it ſacred, and on medals its image is frequently uſed as a ſymbol of divine power. And, in the Eaſt Indies, princes have erected buildings for their entertainment, and have made it a capital crime to kill them. It is ſo certain that the poiſon of the viper is wholly in the yellowiſh fluid lodged

at

at the baſe of the tooth, that, when that was taken away, creatures have been bitten by the viper, and ſuffered no harm; the poiſon of this bag is ſeparated from the blood by a conglomerated gland, lying in the lateral anterior part of the os ſincipitis behind the orbit of the eye, from which gland there is a duct that conveys it into the bag at the root of the teeth. The teeth are hollowed in their lower part for the reception of this poiſon, and the cavity is extended upwards for the conveyance of it, though not to the very top, as ſome have ſuppoſed. It terminates in a long and narrow ſlit below the point out of which the poiſon is emitted into the wound. Galen tells us of people who would ſtop up the apertures of the teeth with a kind of paſte, and then ſuffer themſelves to be bit by the creature and receive no harm from it; but it is much more likely they impoſed on people, and were bitten by other ſerpents that had no poiſon at all.

The poiſonous liquor, taken from the bag and examined by the microſcope, appears to be compoſed of minute ſpiculæ, or darts reſembling the threads of a ſpider's web, but much finer; mixed with ſyrup of violets, it turns it reddiſh, ſo that it is evidently an acid, not, as many have ſuppoſed, an alcali. It is amazing that ſo ſmall a quantity as is received of this poiſon into the blood, ſhould be capable of producing ſuch wonderful and terrible effects.

A violent pain is firſt felt about the wound, then a ſwelling, red at firſt, but ſoon after livid, extending itſelf very quick to the other parts; then faintneſs, a quick, low, and often uninterrupted pulſe, convulſive vomiting of bilious matter, cold ſweats; and, if death does not ſucceed theſe, the ſwelling continues ſome time, the wound becomes a foul ulcer, and the ſkin is uſually diſcoloured for a long time after.

The ancients knew well enough the nature of the viper, to be convinced that its fleſh was not poiſonous; they ate vipers and eſteemed them, as they truly are, nutritive, reſtorative, and cordial; the beſt way to feed on vipers is to cut them into pieces and boil them in chicken broth; they give it no diſagreeable taſte, though they communicate to it all their reſtorative virtues.

Dried or powdered, they are given twenty or thirty grains for a doſe; but this way they loſe the greater part of their virtues. The volatile ſalt is a noble ſudorific. Its doſe is from three to eight or ten grains. The oil is recommended to diſcuſs tumours, and to be held to the noſe of people in hyſteric fits; but it is ſo very fœtid, that it is now wholly out of uſe.

VIRAGO, a woman of extraordinary ſtature and courage; and who, with the female ſex, has the mien and air of a man, and performs the actions and exerciſes of men.

VIRGA, a yard. See YARD.

VIRGA is particularly uſed in law for a verge, or rod, ſuch as ſheriffs and bailiffs carry as a badge of their office.

VIRGÆ, in phyſiology, a meteor called alſo columellæ and funes tentorii; being an aſſemblage of ſeveral ſtreams of light, repreſenting a bundle of rods or ropes. It is ſuppoſed owing to the ſtreaming of the ſun's beams through certain rimulæ, or chinks, at leaſt through the more lax and open parts of a watery cloud, happening chiefly in the morning and evening. There is alſo another kind, conſiſting not of ſtreams of mere white light, but, as it were, painted of various colours like thoſe of the rainbow.

VIRGIN, *Virgo*, a female who has had no carnal commerce with man; or more properly, who has ſtill the flos virginis or maidenhead.

In the ancient chriſtian church, there was a kind of religious order, conſiſting of women, who made open and public profeſſion of virginity; and this before the monaſtic life or name was known in the world. This appears from the writings of Cyprian and Tertullian, who ſpeak of virgins dedicating themſelves to Chriſt, before there were any monaſteries to receive them. Theſe, for diſtinction ſake, are ſometimes called Eccleſiaſtical virgins; and canonicæ, becauſe they were enrolled in the canon, or matricula, of the church. They differed from the monaſtic virgins chiefly in this, that they lived privately in their father's houſes, and in caſes of neceſſity, were maintained by the church; whereas the others lived in community, and upon their own labour.

Whether they made any ſolemn vow, is not agreed among learned writers. Cyprian thinks, their profeſſion of virginity was not ſo ſtrict, but they might afterwards marry, if they could not, or would not, perſevere. But, in the following ages, the cenſures of the church were inflicted on ſuch of them as broke thro' their profeſſion. The council of Ancyra enjoins them a year's penance: the council of Chalcedon excommunicates them. However, there never was any eccleſiaſtical decree for reſcinding, or pronouncing null, ſuch marriages.

As to the conſecration of virgins, it was uſually performed publicly in the church by the biſhop, or ſome preſbyter deputed by him. When a virgin had ſignified her purpoſe to the biſhop, ſhe came and made open profeſſion thereof in the church, and then the biſhop, or his ſubſtitute, put upon her the accuſtomed habit of ſacred virgins. One part of this habit was the ſacrum velamen, or veil: another was, a purple and golden mitre, or crown, which they wore on their heads as a badge of diſtinction. The ordo Romanus has a long form of prayer, and the ceremony of a ring and bracelet, at their conſecration: but the ancient liturgies having nothing of this, their ſilence ſeems to be an argument againſt the antiquity of them.

It is to be obſerved, that the ſacred virgins were not conſecrated to any ſpecial offices in the church, as the deaconeſſes were. However, they were in great eſteem; and had particular honours paid them. They were exempt from the ſame taxes as the clergy were. Their perſons were ſacred, and there were very ſevere laws againſt any who offered the leaſt violence to them. Conſtantine charged his own exchequer with their maintenance; and his mother Helena uſed to entertain them, and wait upon them at her own table. The church gave them a ſhare of her own revenues, and aſſigned them a particular place or apartment in the houſe of God, whither the moſt noble and religious matrons uſed to reſort, to receive their ſalutations and embraces.

VIRGIN is alſo applied figuratively to ſeveral things that retain their abſolute purity, and have never been made uſe of. Thus virgin-wax is that which has never been wrought, but remains as it came out of the hive. Virgin-oil is that which oozes ſpontaneouſly out of the olive, &c. without preſſing. Virgin-gold, is that metal ſuch as it is found pure in the mine, without any mixture of alloy; in which ſtate it is ſometimes ſo ſoft that it will take the impreſſion of a ſeal. Virgin-copper is a native copper found in the mine, and which has never been melted down. Virgin quick-ſilver is that found perfectly formed and fluid in the veins of mines; or at leaſt ſuch as is got from the mineral earth by mere lotion, without fire. Virgin-parchment is that made of the ſkin of an abortive lamb, &c. See WAX, OIL, &c.

VIRGIN'S-THREAD, a ſort of meteor that flies in the air like ſmall untwiſted ſilk; which falling upon the ground, or upon plants, changes itſelf into a ſubſtance like a ſpider's web. In theſe northern climates it is moſt frequent in ſummer, the days being then temperately warm, the earth not exceeding dry, nor yet overcharged with moiſture. This has formerly paſſed for a ſort of dew of an earthy ſlimy nature: but naturaliſts are now agreed that the virgin's threads are no other than ſo many ſpiders webs.

VIRGINITY, *Virginitas*, the teſt or criterion of a virgin, or that which intitles her to the denomination. The phyſicians, both ancient and modern, are exceedingly divided upon the ſubject of virginity, ſome holding that there are no certain marks or teſtimonies thereof, and others, that there are. Moſes eſtabliſhed a teſt, that was to be concluſive among the Jews. The nuptial ſheets, it ſeems, were to be viewed by the relations on both ſides, and the maid's parents were to preſerve them as a token of her virginity, to be produced in caſe her huſband ſhould ever reproach her on that ſcore. In caſe the token of virginity was not found thereon, ſhe

was to be ſtoned to death at her father's door. This teſt of virginity has occaſioned abundance of ſpeculation about the parts concerned; but the niceſt enquiries cannot ſettle any thing certain about them. Dr. Drake ſays expreſsly, that whatever might be expected among the Jews, there is not the ſame reaſon to expect thoſe tokens of virginity in theſe countries; for, beſides that the Hebrews married extremely young, as is the cuſtom in all the Eaſtern countries, there are ſeveral circumſtances which may here fruſtrate ſuch expectations, even in virgins not vitiated, either by any male contact, or any wantonneſs of their own. In effect, in theſe northern countries, the inclemency of the air expoſes the ſex to ſuch checks of perſpiration, as gives a great turn to the courſe of the humours, and drives ſo much humidity through the parts, as may extraordinarily ſupple and relax thoſe membranes from which the reſiſtance is expected, and from which, in hotter countries, it might more reaſonably be depended on.

What moſt commonly paſſes among us for a teſt of virginity, is the hymen; and yet the moſt curious among the anatomiſts are greatly divided, not only about the figure, ſubſtance, place, and perforations of this membrane, but even about the exiſtence thereof; ſome poſitively affirming, and others as flatly denying it. See HYMEN.

VIRGO, in aſtronomy, one of the ſigns or conſtellations of the zodiac, and the ſixth according to order.

It is marked thus ♍, and in Ptolemy's catalogue conſiſts of 32 ſtars, in Tycho's of 39, and in the Britannic of 89.

VIRGULA DIVINA; or BACULUS DIVINATORIUS, &c. a forked branch, in the form of a Y, cut off a hazle ſtick, by means whereof people have pretended to diſcover mines, ſprings, &c. under ground.

The method of uſing it is thus: the perſon who bears it, walking very ſlowly over the places where he ſuſpects mines or ſprings may be, the effluvia exhaling from the metals, or vapour from the water, impregnating the wood, makes it dip or incline, which is the ſign of a diſcovery.

Some diſpute the matter of fact, and deny it to be poſſible. Others, convinced by the great number of experiments alledged in its behalf, look out for the natural cauſes thereof: the corpuſcles, ſay thoſe authors, riſing from the ſprings or minerals, entering the rod, determine it to bow down, in order to render it parallel to the vertical lines which the effluvia deſcribe in their riſe.

VIRGULTUM, in our ancient law books, is uſed for a holt or a plantation of twigs or oſiers. See the article OSIERS.

VIRILE, ſomething that belongs or is peculiar to a man, or the male ſex: thus the virile member is uſed for the penis; virile age, the ſtrength and vigour of a man's age, viz. from thirty to forty-five years, being the age wherein we are equally removed from the extremes of youth and of old age.

VIRILIA, a man's genitals, or privy members, including the penis and teſtes. See the articles PENIS and TESTES.

VIRTSUNGIANUS DUCTUS, in anatomy, a canal uſually called ductus pancreaticus.

VIRTUAL, or POTENTIAL, ſomething that has a power or virtue of acting or doing. The term is chiefly underſtood of ſomething that acts by a ſecret inviſible cauſe, in oppoſition to actual and ſenſible.

VIRTUAL FOCUS, in optics. See FOCUS.

VIRTUALITY, in the ſchools, denotes ſome mode or analogy in an object, which, in reality, is the ſame with ſome other mode, but, out of regard to contradictory predicates, is conſidered as if diſtinct therefrom.

VIRTUALLY, in the ſchools, is applied to a mode of exiſtence. A thing is ſaid to be virtually any where, when it is deemed to be there by ſome virtue, influence, or other effect, produced by it: thus the ſun is virtually on earth, i. e. by his light, heat, &c. A thing is alſo ſaid to be virtually preſent, when the virtues or properties belonging to it, and iſſuing from it, remain: in which ſenſe the forms of the elements are held to be virtually in mixed bodies. A thing is ſaid to be a cauſe virtually, or a virtual cauſe, and that two ways; the firſt, when there is no real diſtinction between it, and the effect attributed to it, and yet it is conceived by us, as if it were really the cauſe thereof: thus immutability in God, is the cauſe of eternity. Secondly, when an effect is not of the ſame kind with the cauſe, and yet the cauſe has the power or virtue of producing the effect; thus the ſun is not formally but virtually hot; and the fire is not contained formally but virtually in heat.

VIRTUE, *Virtus*, a term uſed in various ſignifications. In the general it denotes power, or perfection of any thing, whether natural or ſupernatural, animate or inanimate, eſſential or acceſſary. But in its more proper or reſtrained ſenſe, virtue ſignifies an habit, which improves and perfects the poſſeſſor and his actions.

In this ſenſe virtue is a principle of acting or doing well and readily, and that either infuſed from above, ſuch as are the theological virtues; or acquired by our own application, as the intellectual or moral virtues.

For as there are two things in man, from which all his actions proceed, viz. the underſtanding and the will; ſo the virtue by which he is perfected, or whereby he is diſpoſed to do all things rightly, and to live happily, muſt be twofold: the one of the underſtanding, and the other of the will. That which improves the underſtanding is called intellectual, or dianoetic; and that, the will, moral and ethic; for ſince there are two things required, in order to live aright, viz. to know what ſhould be done, and, when known, readily to perform it; and ſince man is apt to err various ways in each reſpect, unleſs regulated by diſcipline, &c. he alone can deport himſelf rightly in his whole courſe of life, whoſe underſtanding and will have obtained their utmoſt perfection.

Intellectual virtue, then, according to Ariſtotle, is an habit of the reaſonable ſoul, whereby it conceives or ſpeaks the truth, either in affirming or denying. The virtues which come under this claſs are divided into ſpeculative, which are thoſe converſant about neceſſary things, that can only be known or contemplated; and practical, which are converſant about contingent things, that may likewiſe be practiſed. Ariſtotle has another diviſion of intellectual virtues, fetched from the ſubject, as ſome of them are ſeated in the contemplative part, viz. thoſe converſant about neceſſary things, as ſcience, wiſdom, intelligence; and others in the practical part, ſuch are thoſe converſant about contingent things, as prudence, art, &c.

Moral virtue is defined, by Ariſtotle, to be an elective habit, placed in a mediocrity, determined by reaſon, and as a prudent man would determine. Moraliſts uſually diſtinguiſh four principal, or, as they are vulgarly called, cardinal virtues, viz. prudence, juſtice, fortitude, and temperance: the reaſon of which diviſion is founded in this, that for a man to live virtuouſly and honeſtly, it is neceſſary he know what is fit to be done, which is the buſineſs of prudence: that he have a conſtant and firm will to do what he judges beſt; which will perfect the man, either as it reſtrains too violent perturbations, the office of temperance; or as it ſpurs and urges on thoſe that are too ſlow and languid, which is the buſineſs of fortitude; or, laſtly, comparatively with regard to human ſociety, which is the object of juſtice. To theſe four virtues all the reſt are referred, either as parts, or concomitants.

VIRTUES, in the celeſtial hierarchy, the third rank or choir of angels, being that in order between the dominations and powers: to theſe is attributed the power of working miracles, and of ſtrengthening and reinforcing the inferior angels in the exerciſe of their functions.

VIRTUOSO, an Italian term lately introduced into Engliſh, ſignifying a man of curioſity and learning, or one who loves and promotes the arts and ſciences; but among us the term ſeems to be appropriated to thoſe who apply themſelves to ſome curious and quaint, rather than immediately

mediately uſeful, art or ſtudy, as antiquaries, collectors of rarities of any kind, microſcopical obſervers, &c.

VIRULENT, a term applied to any thing that yields a virus, that is, a contagious or malignant pus.

VIS, a Latin word, ſignifying force, or power; adopted by phyſical writers, to expreſs divers kinds of natural powers, or faculties.

VIS *Inertiæ*, or power of inactivity, is defined by Sir Iſaac Newton to be a power implanted in all matter, whereby it reſiſts any change endeavoured to be made in its ſtate, either of reſt, or motion.

This power, then, coincides with the vis reſiſtendi, power of reſiſting, whereby every body endeavours, as much as it can, to perſevere in its own ſtate, whether of reſt, or uniform rectilinear motion: which power is ſtill proportional to the body, and only differs from the vis inertiæ of the maſs, in the manner of conceiving it.

Bodies only exert this power, in changes brought on their ſtate by ſome vis impreſſa, force impreſſed on them. —And the exerciſe of this power, is, in different reſpects, both reſiſtance, and impetus: reſiſtance, as the body oppoſes a force, impreſſed on it to change its ſtate; and impetus, as the ſame body endeavours to change the ſtate of the reſiſting obſtacle.

VIS *Impreſſa*, is defined by Sir Iſaac Newton, to be the action exerciſed on any body, to change its ſtate, either of reſting, or moving uniformly in a right line.

This force conſiſts altogether in the action; and has no place in the body after the action is ceaſed. For the body perſeveres in every new ſtate, by the vis inertiæ alone.

VISCERA, in anatomy, a term ſignifying the ſame with entrails, including the heart, liver, lungs, ſpleen, inteſtines, and other inward parts of the body.

Wounds of the VISCERA.—If any of the viſcera ſituated in the abdomen, as the liver, ſpleen, or kidney, has received a wound from a ſharp inſtrument, at the firſt dreſſing the wound muſt be filled as tenderly as poſſible with lint well ſaturated with highly rectified ſpirit of wine, or ſpirit of turpentine, ſecuring the dreſſings with compreſſes and a bandage; by this means the hæmorrhage will be ſtopped, if no large veſſel is divided. When this part is gained, the wound muſt be treated in the common manner, and the patient kept very low; bleeding him, if of a plethoric habit, and giving daily two or three doſes of Locatellus's balſam; for balſams of this kind are of great ſervice in healing internal wounds.

This is the method to be taken with wounds of the viſcera, which may be diſcovered by the eye or touch. But in ſuch of them as are hidden, and not to be thus diſcovered, all that can be done is to inject vulnerary decoctions, and keep a paſſage open for the evacuation of ſordes, or grumous blood.

VISCIDITY, or VISCOSITY, the quality of ſomething that is viſcid or viſcous, that is glutinous and ſticky, like bird lime, which the Latins call by the name *viſcus*. Viſcid bodies are thoſe which conſiſt of parts ſo implicated within each other, that they reſiſt a long time a complete ſeparation; and rather give way to the violence done them, by ſtretching or extending every way. The too great viſcidity of foods has very ill effects; thus meats or farinæ not fermented, jellies, &c. of animals, tough cheeſe, or curds too much preſſed, produce weight or oppreſſion in the ſtomach, wind, yawnings, crudities, obſtructions of the minuter veſſels in the inteſtines, &c. Hence an inactivity of the inteſtines themſelves, a ſwelling of the abdomen; and hence a viſcidity of the blood, from the re-union of the viſcid particles; obſtructions of the glands; paleneſs, coldneſs, tremors, &c.

VISCUM, miſletoe, in botany. See the article MISLETOE.

VISIBLE, ſomething that is an object of ſight, or viſion; or ſomething whereby the eye is affected, ſo as to produce a ſenſation. See VISION.

The ſchool philoſophers make two kinds of viſibles, or viſible objects: the one proper, or adequate; which are ſuch as are no other way perceivable, but by ſight alone: the other common, which are ſubject to divers ſenſes, as the ſight, hearing, feeling, &c.

Again, the firſt, or proper object of viſion, is of two kinds, viz. light, and colour, for theſe two are only ſenſible by ſight.—The firſt, and primary, viz. light, they make the formal, and colour the material object.

The Carteſians think they philoſophize better, when they ſay, that light, alone, is the proper object of viſion; whether it flow from a luminous body through a tranſparent medium, and retain its firſt name, light; or whether it be reflected from opake bodies, under a certain new modification, or habitude, and exhibit their images; or, laſtly, whether in being reflected, it is likewiſe refracted, after this, or that manner, and affects the eye with the appearance of colour.

But, agreeable to Sir Iſaac Newton's ſentiments, colour alone is the proper object of ſight: colour being that property of light, whereby the light itſelf is viſible, and whereby the images of opake objects are painted on the retina.

Ariſtotle, *De Anima*, Lib. II. enumerates five kinds of common viſibles, which are uſually received for ſuch in the ſchools, viz. motion, reſt, number, figure, and magnitude.—Others maintain nine, as in the verſes,

Sunt objecta novem viſus communia: quantum,
Inde figura, locus, ſequitur diſtantia, ſitus,
Continuumque & diſcretum, motuſque, quieſque.

Authors reaſon very variouſly as to theſe common objects of viſion: there are two principal opinions among the ſchoolmen. The adherents to the firſt, hold, that the common viſibles produce proper repreſentations of themſelves, by ſome peculiar ſpecies or image, whereby they are formally perceived, independently of the proper viſibles.

But the ſecond opinion prevails moſt, which imports, that the common viſibles have not any ſuch formal peculiar ſpecies to become viſible by: but that the proper objects are ſufficient to ſhew themſelves in this or that place or ſituation, and in this or that diſtance, figure, magnitude, &c. by the circumſtances of their conveyance to the ſenſory.

In effect, ſince theſe common viſibles cannot be repreſented alone, for who ever ſaw place, diſtance, figure, ſituation, &c. of itſelf, but are always conveyed along with the images of light and colour to the organ; what neceſſity is there to conceive any ſuch proper images, whereby the common viſibles ſhould be formally perceived by the ſoul? It is much more probable that from the peculiar manner wherein the ſenſitive faculty perceives a proper object, it is appriſed of its being in this or that ſituation or place, in this or that figure, magnitude, &c. How this is effected, may be conceived from what follows.

1. The ſituation and place of viſible objects are perceived without any intentional ſpecies thereof, merely by the impulſe being made from a certain place, and ſituation, either above, or below, on the right, or left, before, or behind; whereby the rays of the proper viſibles are thrown upon the retina, and their impreſſion is conveyed to the ſenſory.

For ſince an object is ſeen by thoſe rays which carry its image to the retina, and in that place to which the viſive power is directed by the rays it receives: as it perceives the impulſe of the rays to come from any place, &c. it is abundantly admoniſhed.

From this principle, ſeveral remarkable phænomena of viſion are accountable for, as,

1. That if the diſtance between two viſible objects be an angle that is inſenſible, the diſtant bodies will appear as if contiguous: whence, a continuous body being the reſult of ſeveral contiguous ones; if the diſtance between ſeveral viſibles ſubtend inſenſible angles, they will appear one continuous body: which gives a pretty illuſtration of the notion of a continuum.

2. If the eye be placed above a horizontal plane, objects, the more remote they are, the higher they will appear, till the laſt be ſeen in a level with the eye. Whence it is, that the ſea, to perſons ſtanding aſhore, ſeems to riſe higher and higher the further they look.

3. If

3. If any number of objects be placed below the eye, the moſt remote will appear the higheſt: if they be above the eye, the moſt remote will appear the loweſt.

4. The upper parts of high objects appear to ſtoop, or incline forwards; as the fronts of churches, towers, &c.—And ſtatues at the tops of buildings, to appear up right, muſt recline, or bend backwards.

II. The mind perceives the diſtance of viſible objects from the different configuration of the eye, and the manner wherein the rays ſtrike the eye, and in which the image is impreſſed thereon. For the eye diſpoſes itſelf differently, according to the different diſtances it is to ſee, viz. for remote objects the pupil is dilated, and the cryſtalline brought nearer the retina, and the whole eye is made more globous; on the contrary, for near objects the pupil is contracted, the cryſtalline thruſt forwards, and the eye lengthened.

The diſtance, again, is adjudged of by the angle the object makes from the diſtinct or confuſed repreſentation of the objects, and the briſkneſs or feebleneſs, or the rarity or ſpiſſitude of the rays. To this is owing, 1. That objects which appear obſcure or confuſed, are judged to be more remote: a principle which the painters uſe, to make ſome of their figures appear farther diſtant than others on the ſame plane. To this it is likewiſe owing, that rooms whoſe walls are whitened, appear the ſmaller: that fields covered with ſnow, or white flowers, ſhew leſs than when clothed with graſs: that mountains covered with ſnow, in the night time, appear the nearer: and that opake bodies appear the more remote in the twilight.

III. The magnitude or quantity of viſible objects, is known chiefly by the angle comprehended between two rays drawn from the two extremes of the object, to the center of the eye. An object appears ſo big as is the angle it ſubtends: or bodies ſeen under a greater angle appear greater; and thoſe under a leſs, leſs, &c. Hence, the ſame thing appears now bigger, and now leſs, as it is leſs or more diſtant from the eye. This we call the apparent magnitude.

Now, to judge of the real magnitude of an object, we conſider the diſtance: for ſince a near and a remote object may appear under equal angles, the diſtance muſt neceſſarily be eſtimated; that if it be great, and the optic angle ſmall, the remote object may be judged great, and *vice-verſa*.

The magnitude of viſible objects, is brought under certain laws, demonſtrated by the mathematicians, as,

1. That the apparent magnitudes of a remote object, are as the diſtances reciprocally.

2. That the co tangent of half the apparent magnitudes of the ſame objects, are as the diſtances: hence, the apparent magnitude and diſtance being given, we have a method of determining the true magnitude: the canon is this, as the whole ſine is to the tangent of half the apparent magnitude, ſo is the given diſtance to half the real magnitude.—The ſame canon, inverted, will, from the diſtance and magnitude given, determine the apparent one.

3. Objects, ſeen under the ſame angle, have their magnitudes proportional to their diſtance.

4. The ſubtenſe A B (plate CXXXVI. *fig.* 1.) of any arch of a circle, appears of equal magnitude in all the points D C E G, tho' one point be vaſtly nearer than another; and the diameter D G, appears of the ſame magnitude in all the points of the periphery of the circle. Hence we take a pretty hint for the moſt commodious form of theatres.

5. If the eye be fixed in A, *(fig.* 2.) and the right line B C be moved in ſuch manner, as that the extremes thereof always fall on the periphery; it will always appear of the ſame magnitude.—Hence, the eye being placed in any angle of a regular polygon, the ſides will appear equal.

6. If the magnitude of an object directly oppoſite to the eye, be equal to its diſtance from the eye, the whole object will be taken in by the eye, but nothing more. Whence, the nearer you approach an object, the leſs part you ſee of it.

IV. The figure of viſible objects is eſtimated chiefly from our opinion of the ſituation of the ſeveral parts thereof. This opinion of the ſituation, &c. enables the mind to apprehend an external object under this or that figure, more juſtly than any ſimilitude of the images in the retina with the object can; the images being frequently elliptical, oblong, &c. when the objects they exhibit to the mind are circles, ſquares, &c. The laws of viſion, with regard to the figures of viſible objects, are,

1. That if the center of the pupil be exactly againſt, or in the direction of a right line, the line will appear as one point.

2. If the eye be placed in the direction of a ſurface, ſo that only one line of the perimeter can radiate on it, it will appear as a line.

3. If a body be oppoſed directly towards the eye, ſo as only one plane of the ſurface can radiate on it, it will appear as a ſurface.

4. A remote arch, viewed by an eye in the ſame plane, will appear as a right line.

5. A ſphere, viewed at a diſtance, appears a circle.

6. Angular figures, at a diſtance, appear round.

7. If the eye look obliquely on the center of a regular figure, or a circle, the true figure will not be ſeen; but the circle will appear oval, &c.

V. The number of viſible objects is perceived, not only by one or more images formed in the fund of the eye; but alſo by ſuch a poſition of thoſe parts of the brain, whence the optic nerves ſpring, as the mind has been uſed to, in attending to a certain place, and that either ſingle, or manifold.

Accordingly, when either of the eyes, with the contiguous part of the brain, are forced out of their juſt paralleliſm with the other, *v. gr.* by preſſing it with the finger, &c. all things appear double: but when they are in the requiſite paralleliſm, though there be two images in the fund of the two eyes, yet the object will appear ſingle. Again, one thing may appear double, or even manifold, not only with both eyes, but even with only one of them open: by reaſon, the common concourſe of the cones of rays, reflected from the object to the eye, either falls ſhort of the retina, or goes much beyond it.

VI. Motion and reſt are ſeen, when the images of objects repreſented in the eye, and propagated to the brain, are either moved, or at reſt; and the mind perceives theſe images either moving or at reſt, by comparing the moved image to another with reſpect to which it changes place: or, by the ſituation of the eye to the object being continually changed. So that motion is only perceived, by perceiving the images to be in different places and ſituations: nor are theſe changes perceived, unleſs effected in time. So that to perceive motion, a ſenſible time is required. — But reſt is perceived by the viſual faculty, from the perception of the image in the ſame place of the retina, and the ſame ſituation, for ſome ſenſible time.

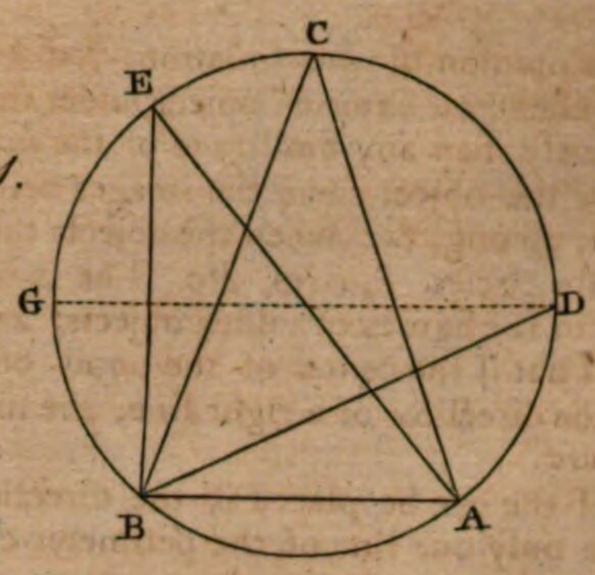
Hence the reaſon, why bodies moving exceeding faſt appear at reſt: thus, a live coal, ſwung briſkly round appears a continued circle of fire; the motion not being commenſurate with viſible time, but much ſwifter than the ſame: ſo that in the time the ſoul requires to judge of any change of ſituation of the image on the retina, or that it is moved from this place to that, the thing itſelf performs its whole circuit, and is in its former place again.

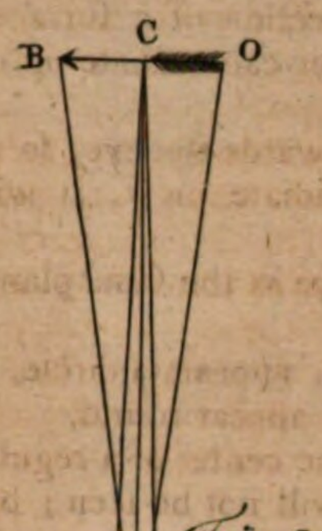
Laws of viſion with regard to the motion of viſibles, are—1. That if two objects, unequally diſtant from the eye, move from it with equal velocity; the more remote one will appear the ſlower: or, if the celerities be proportionable to their diſtances, they will appear to move equally ſwift.

2. If two objects, unequally diſtant from the eye, move with unequal velocities in the ſame direction, their apparent velocities are in a ratio compounded of the direct ratio's of their true velocities, and the reciprocal one of their diſtances from the eye.

3. A viſible object, moving with any velocity, appears to be at reſt, if the ſpace deſcribed in the interval of one ſecond be imperceptible at the diſtance of the eye. Hence it is, that a near object, moving very ſlowly, as the index of a clock, or a remote one very ſwiftly, as a planet, ſeem at reſt.

Fig. 1.





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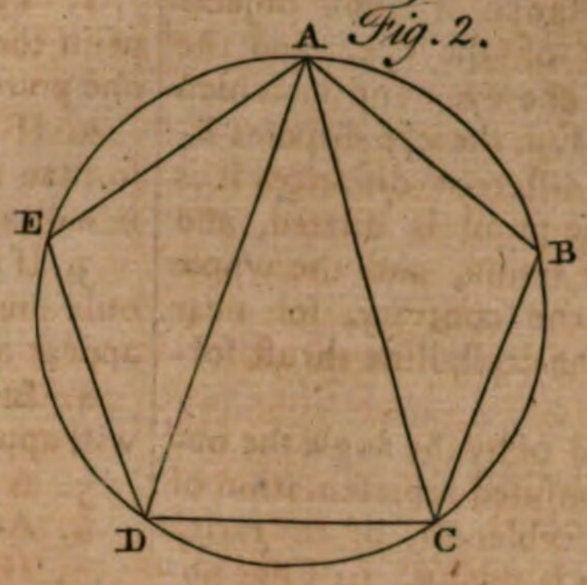

Fig. 2.

Fig. 4.

Fig. 5.

Vision.

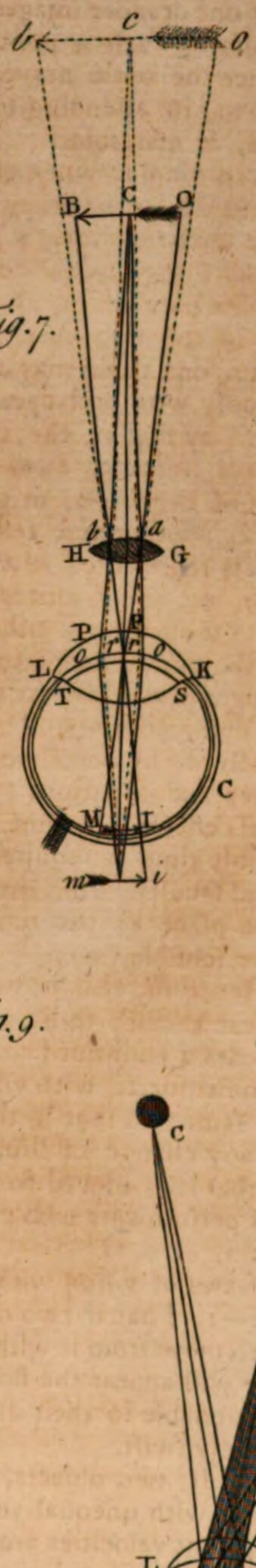

Fig. 7.

Fig. 3.

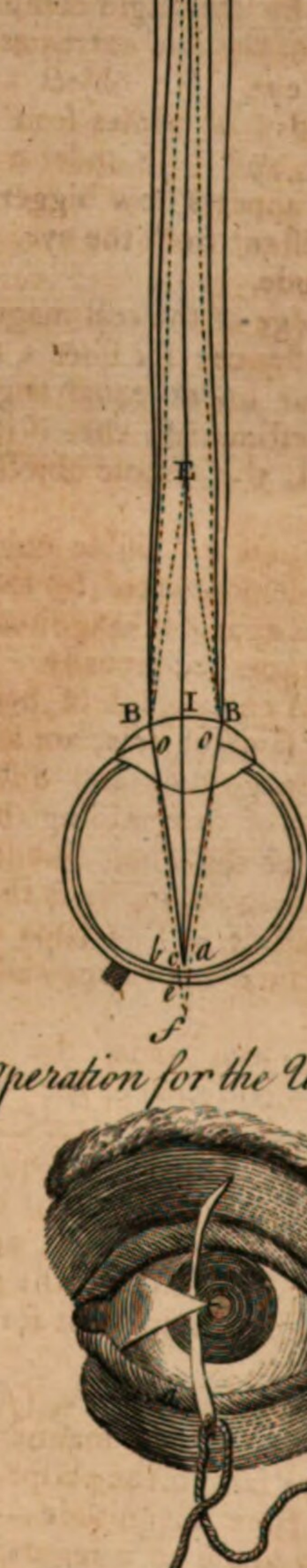

Fig. 6.

Operation for the Unguis.

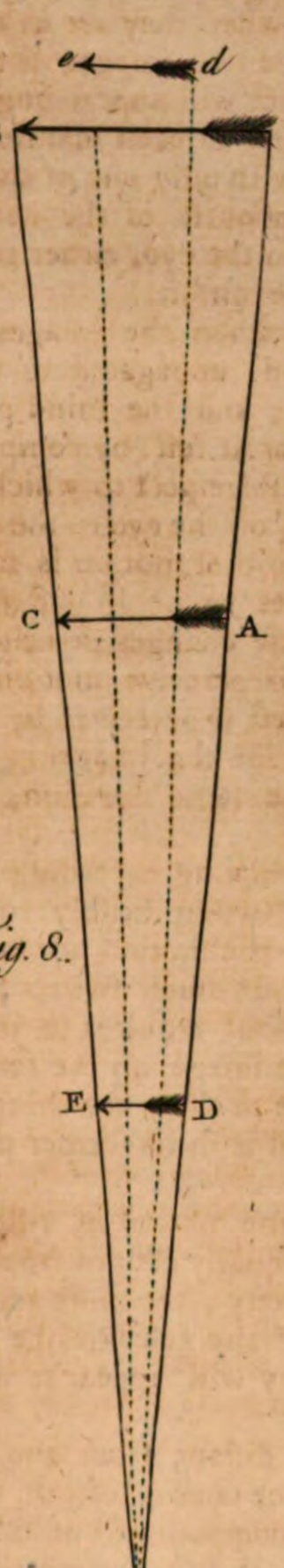

Fig. 8.

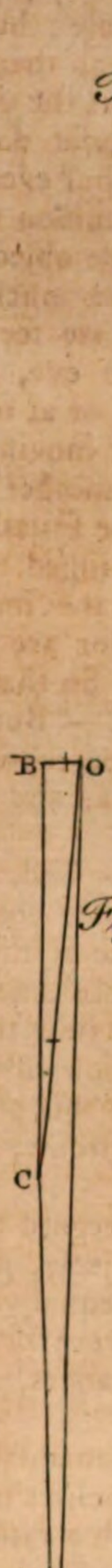

Fig. 9.

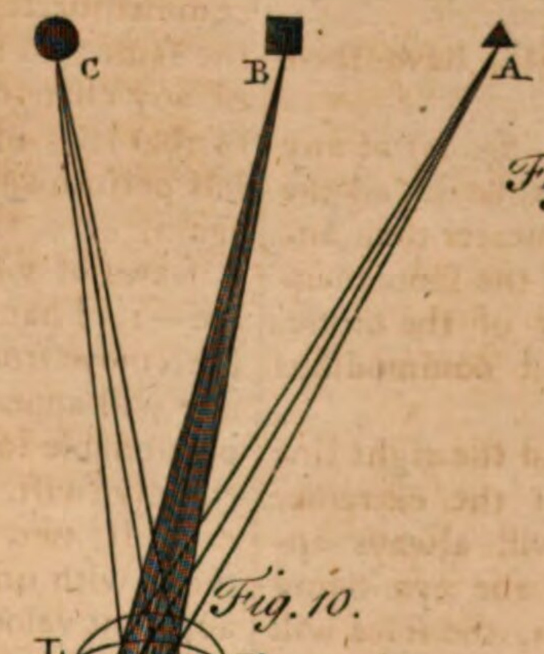

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

4. An object, moving with any degree of velocity, will appear to reſt, if the ſpace it runs over in a ſecond of time be to its diſtance from the eye, as 1 to 1400: nay, in fact, if it be as 1 to 1300.

5. The eye proceeding ſtraight, from one place to another, a lateral object, either on the right or left, will ſeem to move the contrary way.

6. If the eye and the object move both the ſame way, only the eye much ſwifter than the object, that laſt will appear to go backward,

7. If two or more objects move with the ſame velocity, and a third remain at reſt, the moveables will appear fixed, and the quieſcent in motion the contrary way. Thus, clouds moving very ſwiftly, their parts ſeem to preſerve their ſituation, and the moon to move the contrary way.

If the eye be moved with a great velocity, lateral objects at reſt appear to move the contrary way. — Thus, to a perſon, ſitting in a coach, and riding briſkly thro' a wood, the trees ſeem to retire the contrary way; and to people in a ſhip, &c. the ſhores ſeem to recede.

VISIER, or VIZIER, an officer or dignitary in the Ottoman empire, of which there are two kinds; the firſt called by the Turks viſier-azem, that is, grand viſier, is the prime miniſter of ſtate of the whole empire. He commands the army in chief, and preſides in the divan or great council. Next to him are ſix other ſubordinate viſiers, called viſiers of the bench, who officiate as his counſellors, or aſſeſſors in the divan.

VISION, *Viſio*, in optics, the act of ſeeing or perceiving external objects, by means of the organ of ſight, the eye. See EYE.

Such is the ſubſtance and form of the humours of the eye, when lodged in their proper receptacles, that rays of light in paſſing through them, are affected in like manner as in paſſing through a convex lens; and therefore, to underſtand perfectly the nature of viſion, we muſt firſt be acquainted with the doctrine of light and lenſes. See LIGHT and LENS.

Now as the ſeveral pencils of rays flowing from the diſtinct points in the ſurface of an object placed before a lens, are collected into ſo many points at a certain diſtance on the other ſide of the lens, and form an image there, when received upon paper; ſo pencils of rays proceeding from an object placed before the eye at a proper diſtance from it, and being refracted in paſſing thro' the humours of it, are collected into their reſpective foci upon the retina, where they form a repreſentation of that object; and by their impulſes upon the tender nerves of the retina, an idea of the object is excited in the mind. See REFRACTION.

Viſion is diſtinguiſhed into bright and obſcure, diſtinct and confuſed. It is ſaid to be bright when a ſufficient number of rays enter the pupil at the ſame time; and obſcure, when too few: it is called diſtinct when each pencil of rays is collected into a focus exactly upon the retina; and confuſed, when they meet before they come at it, or when they would paſs it before they meet.

Now ſince parallel rays only have their focus upon, or meet in, the retina, they alone can paint there a diſtinct image of an object, or produce a diſtinct viſion of it. If therefore, the object be ſo near, that the rays from any particular point come diverging to the pupil, they will neceſſarily require a greater focal diſtance than the retina or bottom of the eye; whence the rays not being united upon the retina, that point cannot be there diſtinctly repreſented, but will appear confuſed: thus, A B, A B (plate CXXXVI. *fig.* 3.) are two parallel rays falling upon the pupil of the eye; and C B, C B, two other rays, which though really diverging, yet, by reaſon of the remoteneſs of the point C, whence they proceed, will at the entrance of the eye be ſo nearly coincident with the parallel rays, as to have nearly the ſame focal point on the retina, ſo that the point C will there be diſtinctly repreſented by *c*. But if any other point E, be viewed very near the eye, ſo that the angles E B A, which they contain with the parallel rays, be very conſiderable, they will, after refraction, tend towards the point *f*, in the axis of the eye produced, and upon the retina will repreſent only a circular indiſtinct area; like that at *e*, whoſe breadth is equal to *a b*, the diſtance of the rays upon the retina. The ſame point at D, will not be quite ſo much dilated, as the rays D B, D B, have a leſs degree of divergence.

It is found by experience, that the neareſt limit of diſtinct viſion, is about ſix inches from the eye; for if a book be held nearer to the eye than that, the letters and lines will immediately become confuſed and indiſtinct. Now this cauſe of indiſtinct viſion may be in ſome meaſure remedied, by leſſening the pupils, which we naturally do in looking at near objects, by contracting the annular fibres of the uvea; and artificially, by looking through a ſmall hole made with a pin in a card, &c. for then a ſmall print may be read much nearer than otherwiſe: the reaſon is plain, for the leſs the diameter of the aperture or pupil B B, the leſs will the rays diverge in coming from D or E, or the more nearly will they coincide with parallel rays.

Beſides the contraction of the pupil, nature has furniſhed the eye with a faculty of adapting the conformation of the ſeveral parts to the reſpective poſitions of objects, as they are nigh or more remote; for this purpoſe the cornea is of an elaſtic yielding ſubſtance, and the cryſtalline is incloſed with a little water in its capſula, that by the contraction and relaxation of the ciliary ligament, the convexity of both the ſurfaces of the capſula may be a little altered, and perhaps the poſition of the cryſtalline; by which means the diſtance from the retina may be fitted and adjuſted to nigh objects, ſo as to have their images very diſtinctly formed upon the retina.

Nigh objects only have been mentioned, by which are meant ſuch as are near the limit of diſtinct viſion, as between ſix and a hundred inches diſtance, becauſe remoter objects require ſcarce any change of the conformation of the eye; the focal diſtance in them varying ſo very little. Thus, ſuppoſe all the refraction of the eye were equivalent to that of a double and equally convex lens, whoſe radius $r = 1$ inch: if then the object were 10 inches diſtant or $d = 10$, we ſhould have the focal diſtance $f = \frac{d\,r}{d-r} = \frac{10}{9} = 0.11111$; and if another object be diſtant 100 inches, then $d = 100$, and $f = \frac{d\,r}{d-r} = \frac{100}{99} = 0.10101$. The difference between theſe two focal diſtances is 0.0101, viz. ſomething more than the hundredth part of an inch, which the eye can eaſily provide againſt. If we go beyond this, ſuppoſe to an object 1000 inches diſtant, we have $f = \frac{d\,r}{d-r} = 0.1001001$, which is only the thouſandth part of an inch leſs than the former, and is therefore inconſiderable.

Now, rays proceeding from any point, more than 6 inches diſtant from the eye, will, when they enter the pupil, be very nearly coincident with parallel rays; and therefore, to a ſound eye, diſtinct viſion cannot be effected at leſs than 6 or 8 inches diſtance, as may be found by any one who will make the experiment.

Six inches, therefore, conſtitutes the limit of diſtinct viſion, for near objects: we ſhall now conſider the limit for remote objects; for objects may appear indiſtinct and confuſed, by being removed too far from the eye, as well as when they are too near it. And in this caſe, we find objects will appear diſtinct ſo long as their parts are ſeparate and diſtinct in the image formed on the retina; and thoſe parts will be ſeparate ſo long as the axis of the pencils of rays, which paint them, are ſeparate at their incidence on the retina; that is, ſo long as the angle they contain is not leſs than one-tenth of a degree: for it is found, by experience, that objects and their parts become indiſtinct, when the angle they ſubtend at the pupil of the eye is leſs than that quantity.

Thus, ſuppoſe O B (*fig.* 4.) to be a circle one-tenth of an inch in diameter, it will appear diſtinct with its central ſpot, till you recede to the diſtance of 6 feet from it, and then it becomes confuſed; and if it be one-fifth of an inch, it will begin to be confuſed at 12 feet diſtance, and ſo on; in which caſes, the angle ſubtended at the eye, viz. O A B, is about one-tenth of a degree, or 6 minutes.

And thus all objects, as they are bigger, appear diſtinct at a greater diſtance; a ſmall print will become confuſed at a leſs diſtance than a larger; and in a map of England, the names of places in ſmall letters become firſt indiſtinct, where thoſe in capitals are very plain and legible; at a bigger diſtance theſe become confuſed, while the ſeveral counties appear well defined to a much greater diſtance: theſe alſo at laſt become ſo indiſtinct as not to be known one from another, when at the ſame time the whole iſland preſerves its form very diſtinctly to a great diſtance; which may be ſo far increaſed, that it alſo, at laſt, will appear but a confuſed and unmeaning ſpot.

We have ſeen the cauſes of indiſtinct viſion in the objects, and ſhall now enquire what may produce the ſame in the eye itſelf.

And firſt it is to be obſerved, that there is a proper degree of convexity in the cornea K P L (*fig.* 5.) and cryſtalline S T, for converging parallel rays to a focus on the bottom of the eye, in a ſound ſtate; hence every diſtant object O B, will have its image I M, accurately depicted on the retina, and by that means produce diſtinct viſion.

But if the cornea K P L (*fig.* 6.) or cryſtalline S T, or both, ſhould chance to be a little more convex than juſt, it will cauſe the pencil of rays *o* C *o*, which comes to the pupil *o o*, from any point C in the object O B, to unite in a focus before they arrive at the retina in the bottom of the eye; the image I M, of the object O B, will be formed in the body of the vitreous humour, and will therefore be very confuſed and indiſtinct on the retina at *i m*. A perſon having ſuch an eye, is called myops, in alluſion to the eye of a mouſe, by reaſon of its great convexity. To remedy this defect of the eye, a concave lens E F is applied before it; for, by this means the rays C *a*, C *b*, which fall diverging on the lens, will, after reflection through it, be made to proceed ſtill more diverging, viz. in the directions *a r*, *b r*, inſtead of *a o*, *b o*, as if they came from the point *c* inſtead of C. Hence it follows, that ſince the rays are made to fall with greater divergence upon the eye, they will require a greater focal diſtance to be united in the axis; and, conſequently, the focus may be made to fall very nicely on the retina, by uſing a lens E F, of a proper degree of concavity; ſo that diſtinct viſion will be effected, in the ſame manner as in an eye of a juſt conformation.

Since the point *c*, is nearer to the eye than the point C, the apparent place of objects ſeen through a concave lens is nearer than the true place; or the object will appear at *O B*, inſtead of O B; and alſo, ſince converging rays O *a*, B *b*, proceed leſs converging after refraction than before, the object appears under a leſs angle; and, therefore, the apparent magnitude of objects, ſeen by a concave lens, is leſs than the true: the object is alſo leſs luminous or bright, ſeen thro' ſuch a lens, than without it; becauſe the rays being rendered more divergent, a leſs quantity enters the pupil of the eye, than otherwiſe would do: for the picture is always more or leſs bright, according as it is made by a greater or leſs quantity of rays. Laſtly, it appears from what has been ſaid, that when a concave lens E F, cannot be applied, we may ſtill effect diſtinct viſion, by leſſening the diſtance between the object and the eye: for it is plain, if O B be ſituated at *O B*, the image I M, will recede to *i m*, upon the retina, and be diſtinct, in the ſame manner as when made ſo by the lens E F.

On the other hand, when the cornea or cryſtalline is too flat, &c. (as often happens by age) an object O B (*fig.* 7.) placed at the ſame diſtance from the eye P C, as before, will have the rays C *o*, C *o*, after refraction in the eye, proceed to a focus beyond the bottom of the eye, in which if a hole were made, in an eye taken out of the head, the rays would actually go on, and form the image *i m*; which image muſt, therefore, be very confuſed and indiſtinct on the retina. To remedy this defect, a convex lens G H, is applied, which cauſes the diverging rays C *a*, C *b*, to fall leſs diverging upon the eye, or as if they came from a point more remote, as *c*; by which means the focal diſtance is ſhortened, and the image duly formed on the retina at I M, by which diſtinct viſion is produced.

Hence the apparent place of the object at *c*, is more diſtant than the true place is at C; and its apparent magnitude *O B* is greater than the true, becauſe the converging rays O *a*, B *b*, are by this lens after refraction made to unite ſooner than before, and ſo to contain an angle *O P B* greater than the true O P B. The object appears through a lens brighter than without, becauſe by this means a greater quantity of rays enter the pupil; for the rays *a o*, *b o*, are by the lens made to enter in the directions *a r*, *b r*, which are nearer together, and leave room for more to enter the pupil all around between *o* and *r*.

As the image of the object painted on the retina is greater or leſs, ſo will the apparent magnitude of the object be likewiſe; or, in other words, the angle I P M (*fig.* 8.) ſubtended by the image is always equal to the angle O P B ſubtended by the object at the eye, and therefore the image I M will be always proportionable to the object O B. Hence it follows, that the angle O P B under which an object appears, is the meaſure of its apparent magnitude.

Therefore objects of different magnitudes, as O B, A C, D E, which ſubtend the ſame angle at the eye, have the ſame apparent magnitude, or form an equal image in the bottom of the eye. Hence it is that objects at a great diſtance have their magnitude diminiſhed proportionally; thus the object D E removed to *D E* appears under a leſs angle *D P E*, and makes a leſs image on the retina, as is ſhewn by the dotted lines.

The angles of apparent magnitude O A B, O C B, (*fig.* 9.) when very ſmall, are as their ſines, and therefore as the ſides O C and O A, or B C and B A; that is, the apparent magnitude of the object O B, at the diſtances B C and B A, is inverſely as thoſe diſtances; or its magnitude at C is to that at A as A B to C B.

The more directly any object is ſituated before the eye, the more diſtinctly it will appear; becauſe thoſe rays only which fall upon the eye near its axis can be convened to a point in the bottom of the eye on the retina, and therefore that part of the image only which is formed by the direct pencil of rays can be clear and diſtinct; and we are ſaid to ſee an object by ſuch a pencil of rays, but only to look at it by the others which are oblique. Suppoſe A, B, C, (*fig.* 10.) repreſent three pieces of paper ſtuck up againſt the wainſcot of a room at the height of the eye; if then a perſon places himſelf ſo before them, and ſhutting his right eye views them with his left, it is very remarkable that the paper B, whoſe pencil of rays falls upon the inſertion D of the optic nerve D E, will immediately vaniſh or diſappear, while the two extreme papers C and A are viſible; and by altering the poſition of the eye, and its diſtance, any of the papers may be made to vaniſh, by cauſing the pencil of rays to fall on the point D. Why the rays of light ſhould not excite the ſenſation of viſion in the point D, where the fibres of the nerves begin to ſeparate and expand every way to form the retina, is not eaſy to ſay. But it is worth notice, that the nerve D E is for that reaſon placed on one ſide of the eye, where only the oblique rays come, the loſs of which is not conſiderable, and no way affects or hinders the perfection of ſight: whereas had it entered in the middle of the bottom of the eye, it had rendered uſeleſs all the direct rays, by which the moſt perfect and diſtinct viſion is effected; and we could have had only a confuſed imperfect conception of objects, by oblique collateral rays.

The laws of viſion, brought under mathematical demonſtration, make the ſubject of optics, taken in the greateſt latitude of the word; which is commonly uſed, in a more reſtrained ſenſe, for the doctrine of direct or ſimple viſion, performed by rays paſſing directly, or in a ſtraight line, from the object to the eye. The doctrine of real viſion, or that performed by means of rays reflected from mirrors, makes the ſubject of catoptrics; and refracted viſion, or that performed by rays refracted thro' glaſs lenſes, or other mediums, conſtitutes that branch of optics, called dioptrics.

VISION, among divines, is uſed for an appearance, which God occaſionally ſent his prophets and ſaints; either by way of dream, or in reality.

Such

Such were the viſions of Ezekiel, Amos, &c. the viſion of St. Paul, lifted up to the third heaven, &c. of Joſeph, by which he was aſſured of the purity of the virgin, &c.

Many among the Romiſh ſaints ſtill pretend to viſions: thus the Revelations of St. Bridget are ſo many viſions.

Hence the word has come into diſreſpect, and become a common name for all chimeras, or ſpectres, which either our folly or fear poſſeſſes us with: and hence, a perſon that frames to himſelf wild romantic notions, is called a viſionary. Quevedo's viſions are deſcriptions of what paſſed in the imagination of that author.

Beatific VISION, denotes the act whereby the angels and bleſſed ſpirits ſee God in paradiſe.

VISITATION, in law, an act of juriſdiction, whereby a ſuperior, or proper officer, viſits ſome corporation, college, church, or other public or private houſe, to ſee that the laws and regulations thereof be duly obſerved.

Among us, viſitation is that office performed by the biſhop in every dioceſe once in three years, or by the archdeacon every year, by viſiting the churches and their rectors throughout the whole dioceſe, &c. The biſhop's commiſſary alſo holds a court of viſitation, to which he may cite all church-wardens and ſideſmen; and to whom he exhibits his articles, and makes inquiry by them.

VISUAL, in general, ſomething belonging to viſion. See VISION.

Thus, rays of light, coming from an object to the eye, are called viſual rays; and the viſual point in perſpective is a point in the horizontal line, wherein all the viſual rays unite. See RAY and PERSPECTIVE.

VITAL, in phyſiology, an appellation given to whatever miniſters principally to the conſtituting or maintaining of life in the bodies of animals: thus, the heart, lungs, and brain are called vital parts; and thoſe operations of theſe parts, whereby the life of animals is maintained, are called vital functions. See FUNCTION.

VITREOUS *Humour of the Eye*, is ſo called from its reſemblance to glaſs infuſion, being very like a fine clear jelly in appearance: it probably, ſays Heiſter, conſiſts of extremely fine veſicles, containing a limpid and perfectly pellucid humour. It fills the poſterior part of the eye, and is every where contiguous to the hinder part of the retina, which it ſerves alſo to expand. See the article EYE.

VITRIFICATION, in chemiſtry, is the converting a body into glaſs, by means of fire. See GLASS.

Of all bodies, fern-aſhes, ſand, pebbles, &c. vitrify the moſt readily; and accordingly, it is of theſe that glaſs is principally made.

VITRIOL, *Vitriolum*, a ſaline cryſtalline concrete, compoſed of metal united with a certain acid called the vitriolic acid. There are three metals with which this acid is found naturally combined, zinc, copper, and iron: with the firſt it forms a white, with the ſecond a blue, and with the third a green ſalt.

1. White vitriol, or vitriol of zinc; found in the mines of Goſlar, ſometimes in tranſparent pieces, more commonly in white effloreſcences; which are diſſolved in water, and cryſtallized into large irregular maſſes, ſomewhat reſembling fine ſugar; in taſte ſweetiſh, nauſeous, and ſtyptic.

The common white vitriol of the ſhops contains a quantity of ferrugineous matter; of which, in keeping, a part is extricated from the acid, in an ochery form, ſo as to tinge the maſs of a yellow hue. On diſſolving the whitiſh pieces in water, a conſiderable portion of ochre immediately ſeparates: the filtered ſolution, tranſparent and colourleſs, becomes again turbid and yellow on being made to boil, and depoſits a freſh ochery ſediment; and a like ſeparation happens, though much more ſlowly, on ſtanding without heat. Hence, when the ſolution is evaporated to the uſual pitch, and ſet to cryſtallize, the cryſtals generally prove foul; unleſs ſome freſh acid be added, as an ounce of the ſtrong ſpirit or oil of vitriol to a pound of the ſalt, to keep the ferrugineous matter diſſolved: this addition both ſecures the whiteneſs of the cryſtals, and prevents their growing ſoon yellow in the air. White vitriol generally contains alſo a ſmall portion of copper, diſtinguiſhable by the cupreous ſtain which it communicates to poliſhed iron immerſed in ſolutions of it, or rubbed with it in a moiſt ſtate. The quantity of this metal is ſo exceedingly minute, that it is not, perhaps, of any inconvenience in any of the intentions for which white vitriol is employed: the ſeparation, if it ſhould be thought neceſſary, may be effected, by boiling the ſolution for ſome time, along with bright pieces of iron, which will extricate all the copper; by continued or repeated coction, greateſt part of the ferrugineous matter alſo may be ſeparated.

White vitriol is ſometimes given, from five or ſix grains to half a dram or more, as an emetic; and appears to be one of the quickeſt in operation of thoſe that can be uſed with ſafety. Externally, it is employed as a cooling reſtringent and deſiccative: a dilute ſolution of it, of a dram for inſtance in a pint of water, is an excellent collyrium in defluxions and ſlight inflammations of the eyes, and, after bleeding and purging, in the more violent ones: a ſolution of it with alum, in the proportion of two drams of each to a pint of water, is uſed as a repellent fermentation for ſome cutaneous eruptions, for cleanſing foul ulcers, and as an injection in the fluor albus and gonorrhœa, when not accompanied with virulence. This vitriol is ſometimes likewiſe employed as an errhine, and ſaid to be a very effectual diſſolvent of mucous matters; in which intention it is recommended, in the German Ephemerides, againſt obſtructions of the noſtrils in new-born infants.

2. Blue vitriol or vitriol of copper, commonly called Roman or Cyprian vitriol or blue-ſtone. This kind of vitriol is in many places produced from ſulphureous ores of copper: the acid of ſulphur is no other than the vitriolic; and the inflammable principle of the ſulphur being diſſipated either by fire or by a ſpontaneous reſolution of the mineral, the acid remains combined with the copper: the vitriol, now formed, is either extracted by the application of water, or waſhed out by rain or ſubterraneous waters: hence in ſome copper mines are found blue waters, which are true vitriolic ſolutions of copper, and which depoſite that metal on the addition of iron or of any other ſubſtance which the acid more ſtrongly attracts. The greateſt part of the blue vitriol, now met with in the ſhops, is prepared in England, by artificially combining copper with ſulphur, or its acid.

The vitriol of copper is of an elegant ſapphire blue colour, hard, compact, and ſemitranſparent; when perfectly cryſtallized, of a flattiſh, rhomboidal, decahedral figure; in taſte extremely nauſeous, ſtyptic, and acrid. Expoſed to a gentle heat, it firſt turns white, and then of a yellowiſh red or orange colour: on increaſing the fire it parts, difficultly, with its acid, and changes, at length, to a very dark red calx reducible, by fuſion, with inflammable fluxes, into copper.

This ſalt, like the other preparations of copper, acts, in doſes of a few grains, as a moſt virulent emetic. Its uſe is only external, as a detergent, eſcharotic, and for reſtraining hemorrhages: for which laſt intention, a ſtrong ſtyptic liquor is prepared in the ſhops, by diſſolving three ounces of blue vitriol, and two of alum in a pint and a half of water, then adding two ounces of oil of vitriol, and filtering the mixture for uſe.

3. Green vitriol or vitriol of iron; commonly called Engliſh vitriol or copperas. This ſpecies of vitriol has iron wholly for its baſis. It is formed ſolely of that metal, diſſolved by the acid of ſulphur, and by means of water, reduced to the form of ſalt. It is of two kinds, natural and factitious; the natural, or native kind, is known by the name of green vitriol, the common appellation of the other is copperas.

It is a tolerably pure and pellucid ſalt, of a compact and regular texture, conſiderably heavy, but friable, and eaſily ſhattering to pieces on the ſmalleſt blow. It is of a fine, pale, graſs-green colour: it will not melt, or wholly run to water in a damp air, but it is very apt to be moiſt on the ſurface; it very readily diſſolves in water, and after evaporation, freely ſhoots again into regular cryſtals, the true figure of which is a regular rhomboid;

rhomboid; but they are ſeldom perfect or regular. Expoſed to the fire, it becomes thin like water, boiling and bubbling up, and emitting a very thick ſume. After this it grows thicker, and, finally, calcines to a grey powder; and from this, if the fire be continued and made more violent, to a fine purple matter, called calcothar of vitriol.

A ſolution of this vitriol will curdle milk. It gives a greeniſh colour to ſyrup of violets. It makes no change in a ſolution of corroſive ſublimate; with lime water, or a ſolution of tartar, it becomes of a duſky yellowiſh colour; and with a decoction of galls, which is the readieſt of all teſts for it, it becomes ink. It is to be choſen in large pieces, dry, clear, and tranſparent, of a fine green colour, and with none of that earthy matter among it, which is too frequent in the larger parcels of it.

The native green vitriol is found often in irregularly ſhaped maſſes, from an ounce or two, to a pound or more in weight, among the ore in the mines where there is iron. Theſe maſſes are frequently covered over with irregular prominences, ſometimes with regularly figured cryſtals of a rhomboidal form on their ſurfaces. It is alſo frequently found hanging down from the roofs, and along the ſides of caverns, in form of iſicles, perfectly reſembling thoſe of ſparry matter, which our Derbyſhire mines abound with, and which are commonly known by the name of ſtalactitæ. This is called ſtalactical vitriol. There are of theſe from the thickneſs of a ſtraw to three or four inches in diameter, and from an inch to two feet in length. They are generally formed pretty regularly, tapering from the baſe to the oppoſite end; but they are not ſmooth or equal on the ſurface, but uſually full of roundiſh protuberances; they appear tranſparent, if held up to the light, and when broken, ſhew an even and gloſſy ſurface.

Native vitriol, of both theſe forms, is frequent in the mines of Goſſelaer in Saxony, in thoſe of Bohemia, and in ſeveral of thoſe of the Harts-foreſt, in Germany.

The factitious green vitriol which we uſually call copperas, is, in all reſpects, the ſame with the native, except in its form, and manner of production.

The vitriol, in maſſes of foſſile matter from which this is ſeparated, is truly in the ſtate of ore; it does not appear to the eye, but it is more or leſs diſcoverable by the taſte.

The ſeveral kinds of vitriol ores, in this ſenſe of the term, are very different from one another, and are very numerous. The moſt frequent, and one of the richeſt in vitriol, is the common pyrites of our clay-pits. This is a body which aſſumes various forms in its ſeveral maſſes, but is always of a duſky greeniſh colour; and where it has not been determined in its ſhape by ſome animal or vegetable mould, is uſually flattiſh, and is ſeldom found in very large maſſes. It is extremely frequent in all our clay pits about London, in which places we meet with it, alſo, in a multitude of other various forms, it ſometimes having been caſt in ſhells of ſea-fiſh, eſpecially of the buccinum, nautilus, and concha anomia kind, and very frequently in the form of wood, whoſe pores it has entered, and lodged itſelf in the ſame manner as in the particles of ſtone in the ordinary petrified wood. Among the various pieces of wood it meets with in theſe ſtrata, ſome of which appear to have been fragments of the bodies of trees, others of the ſmaller branches, it not unfrequently has lodged it among ſuch maſſes as have before been eaten by ſea-worms, and have formed the ſyringoides. Theſe ſpecies, when petrified in the common way, make what is called the lapis ſyringoides; in this ſtate they are called the pyrites ſyringoides; in all theſe, and the thouſand other ſhapes in which this pyrite offers itſelf to our view, it is itſelf the ſame ſubſtance in every reſpect. It is hard, compact, and firm, as it lies in the earth, though it ſoon grows friable and ſhattery on being expoſed to the air. It is covered with no coat or cruſt, but ſhews its own natural ſurface; and when broken, it appears of a ſimple uniform ſtructure, and of the ſame colour within as at the ſurface. If ſtruck againſt a piece of ſteel, it gives fire freely, and the ſparks are large and very bright. It will not ferment with any acid, and when tried by fire, it cracks and burſts, and burns with a fine blue flame, and a ſtrong ſmell of ſulphur, finally, calcining to a fine, deep, red colour.

Beſides this ſpecies of the pyrites, which is the moſt frequent, the richeſt in vitriol, and the moſt uſually worked for it, all the other pyritæ, and all the marcaſites, without one exception, contain it. There are ſeveral ſtony ſubſtances, alſo, very highly impregnated with it, of which, in Germany particularly, they meet with ſome that are of a reddiſh hue, as if they had been naturally calcined in the earth; others of a fine, bright, golden yellow, from the quantity of the yellow mundic contained in them; others of a duſky grey, and others of a deep black. The ores of metals, alſo, frequently contain large quantities of the ore of this vitriol among them, and even the laſt mentioned kinds of genuine ores of the vitriol, not unfrequently, contain, alſo, particles of the metals among them. The mundic, or common marcaſite of Cornwall, is of this number, containing, frequently, metalline matter in it, and always vitriol and ſulphur.

The pyritæ that afford this vitriol, always contain iron and ſulphur in them, and copper very frequently, and ſometimes arſenic: when they contain only iron, they generally crack and ſhoot out their ſalt very quickly and eaſily on being expoſed to the air; thoſe which contain copper, eſpecially if there is arſenic among the maſs, do not break ſo ſoon, but often will ſtand the effects of the air ever ſo long, and require to be calcined and wetted before they will ſhoot, or give any token of the ſalt they contain, though they have it in great abundance.

A multitude of other ſubſtances contain the green vitriol, which one would hardly ſuſpect of it; among theſe we may mention the brown iron ore of the Goſſelaer mines, the reddiſh ferrugineous ſtones found over the ſtrata of coal in Mendip-hills, and in ſome other parts of England, and the common calamine. All calamine contains ſome of this green vitriol; but from the naturally red pieces, it ſeparates in a very large proportion; and in the cavernous hollows of ſome of its maſſes ſent from the German mines, ſmall maſſes of the native white vitriol have alſo been ſeen, which is the leſs wonderful, indeed, as zinc, which is the metalline matter contained in calamine, is the very ſubſtance which gives the vitriol of iron its white colour.

The calamines are all of the number of thoſe ores which will not ſhoot on being merely expoſed to the air; they muſt be previouſly roaſted and ſprinkled, at times, with water.

The ores of alum, alſo, frequently contain vitriol, and the alum is leſs eaſy ſeparable from theſe, than from ſuch as contain only that ſalt. Hence ariſes the account we meet with, among people leſs informed of theſe things, of ſtones and earths very ſtrongly taſting of alum, but from which no alum can be obtained. The buſineſs is, that in working them for their ſalt, the vitriol ſhoots firſt, as the common ſalt mixed with nitre does, in the purifying that ſalt; but if theſe people, after the vitriol is ſhot, would throw ſome alcali into the remaining liquor, they would ſoon find their alum. The common Iriſh ſlate, and many other of the foſſile alum ores, contain vitriol in abundance.

The Germans make green vitriol from any of the ores we have been mentioning, by burning, and afterwards expoſing them to the air; and in ſome places they firſt of all melt the ſulphur from them, and then work them for their vitriols.

In England, where the greateſt quantity of this vitriol is made, it is formed from the common greeniſh pyrites, with the addition of old iron. The people who collect theſe pyrites, are not at the pains of ſearching it among the ſtrata, but they pick it up on the ſea coaſts of Eſſex, and other places, under cliffs, compoſed of ſtrata of clay, out of which the ſea waſhes it, and leaves it on the ſhore. This pyrites they expoſe to the air in vaſt heaps, and, in conſequence of that, it by degrees begins to ſwell and burſt, and ſhoot out in ſalts. They pile up theſe heaps in a kind of pits lined with clay,

clay, now and then turning them when their ſalt begins to appear in a downy efflorescence on the ſurfaces of the pieces they fall into, on breaking; the time of making vitriol being near.

Theſe efflorescences diſſolve by the rains and dews, and are, in fine, converted into an acrid liquor, which is conveyed from the bottom of the pits into leaden boilers, into which a quantity of old iron is alſo thrown; the fire is made under theſe, and the liquor is kept boiling for three days, or more, and is all the time ſupplied with freſh parcels of iron, ſo long as it will act upon them. The old iron, picked up by the poor people about our ſtreets, is ſold to the vitriol or copperas makers with this intent. When the liquor is boiled to a proper conſiſtence, it is let out into large coolers, in which there are ſticks placed acroſs, to which, as well as to the ſides of the veſſel, the vitriol adheres in large cryſtals, of the form and texture above deſcribed.

Pure vitriol of iron is conſiderably tranſparent; of a fine bright, though not very deep, graſs green colour; of a nauſeous aſtringent taſte, accompanied with a kind of ſweetiſhneſs. Diſſolved, and ſet to cryſtallize, it ſhoots into thick rhomboidal maſſes; a part generally riſing at the ſame time in efflorescences about the ſides of the veſſel. The ſolution depoſites in ſtanding a conſiderable quantity, and in boiling a much larger one, of the metallic baſis of the vitriol, in form of a ruſty calx or ochre: iron ſeems to be the only body that thus ſeparates ſpontaneouſly, in any conſiderable quantity, from the vitriolic acid. On expoſing the vitriol itſelf to a moiſt air, a ſimilar reſolution happens on its ſurface; which, ſooner or later, according as the acid is more or leſs ſaturated with the metal, changes its green to a ruſty hue. In a warm dry air, it loſes a part of the phlegm or water neceſſary to its cryſtalline form, and falls by degrees into a white powder. Expoſed to a gentle fire, it liquefies and boils up; but ſoon changes, on the exhalation of the watery part that rendered it fluid, to a ſolid, opake, whitiſh or grey maſs: this, pulveriſed and urged with a ſtronger fire, continues to emit fumes, becomes yellow, afterwards red, and, at length, having parted with moſt of its acid as well as its phlegm, turns to a deep purpliſh-red calx, revivable by inflammable ſubſtances into iron.

Pure green vitriol is in no reſpect different from the artificial *ſal martis*. It is one of the moſt certain of the chalybeate medicines, ſcarcely ever failing to take effect where the calces and other indiſſoluble preparations paſs inactive through the inteſtinal tube. It may be conveniently given in a liquid form, largely diluted with aqueous fluids: two or three grains or more, diſſolved in a pint or a quart of water, which from this quantity receives no diſagreeable taſte, may be taken in a day, divided into different doſes. This vitriol is uſed alſo, eſpecially when calcined, as an external ſtyptic: the ſtyptic of Helvetius, and as is ſaid that of Eaton, is no other than French brandy very ſlightly impregnated with the calcined vitriol: a dram of the vitriol is commonly directed to a quart of the ſpirit, but only a minute portion of the dram diſſolves in it. As French brandy has generally an aſtringent impregnation from the oaken caſks in which it has been kept, the vitriol changes it, as it does the watery infuſions of vegetable aſtringents, to a black colour: but makes no ſuch change in ſpirituous liquors that have not received ſome aſtringent tincture.

It is from the green vitriol that the acid called vitriolic has been generally extracted; by diſtilling the calcined vitriol in earthen long necks, with a ſtrong fire continued for two days or longer. The diſtilled ſpirit appears of a dark blackiſh colour; and contains a quantity of phlegm, greater or leſs, according as the vitriol has been leſs or more calcined. On committing it a ſecond time to diſtillation, in a glaſs retort placed in a ſand-heat, the phlegmatic parts riſe firſt, together with a portion of the acid, and are kept apart under the name of ſpirit or weak ſpirit of vitriol: at the ſame time the remaining ſtrong ſpirit, or oil as it is called, loſes its black colour and becomes clear, and this is the uſual mark for diſcontinuing the rectification.

The ſtrong acid or oil of vitriol is the moſt ponderous of unmetallic fluids, and the moſt fixed of ſaline ones, yielding no ſmell in the greateſt heat of the atmoſphere, and requiring, to make it boil or diſtil, a heat conſiderably greater than that in which lead melts. Expoſed to the air, it imbibes its humidity, ſo as to gain by degrees an increaſe of about twice its own weight. Mixed directly with water, it produces a heat ſo great as to render the veſſel inſupportable to the hand: glaſs veſſels are apt to crack from the ſuddenneſs of the heat, unleſs the commixture is very ſlowly performed. The moſt ready method of diſtinguiſhing it, in a dilute ſtate, or when mixed with other acids, is by adding a ſolution of ſome calcareous earth, as chalk, made in any kind of acid liquor: this ſolution is by a minute portion of the vitriolic acid rendered milky, but ſuffers no change from any other ſpecies of acid.

If the long-neck, in the extrication of the acid from vitriol, happens to crack in the fire, the acid that riſes after this period is found remarkably changed. It emits in the air ſuffocating vapours like the fumes of burning brimſtone, and riſes in diſtillation with a heat not much greater than that which the hand can bear: to the taſte it diſcovers little corroſiveneſs or acidity. Combined with alcaline ſalts, it loſes its pungent odour; but on the addition of any other acid, it is diſengaged from the alcali, ſo as to riſe again in diſtillation as volatile and ſuffocating as before. It deſtroys or whitens the blue and red colours of the flowers of plants; whereas, in its fixt ſtate, like the other acids, it changes the blue to red, and heightens thoſe which are naturally red. This volatile ſpirit loſes its ſuffocating odour, and reſumes its corroſiveneſs, fixedneſs, and other qualities, by expoſure to the air, which ſeems to carry off the inflammable principle whereon its volatility depended.

The fumes of burning brimſtone are no other than the vitriolic acid in its volatile ſtate. If a little burning ſulphur be ſuſpended over ſome water in a cloſe veſſel till the fumes ſubſide, and this repeated with ſuch portions of ſulphur till about half a pound has been uſed to a quart of water, the liquor will be found ſtrongly impregnated with the volatile ſuffocating acid; and in keeping for ſome time, if the veſſel is not cloſely ſtopt, it will become exactly ſimilar to water acidulated with the fixt acid. If a very large glaſs, open at bottom, be hung over the burning ſulphur, in a damp place ſcreened from wind, a part of the fumes will condenſe upon the ſides of the glaſs, and run down in drops, which may be collected by placing a glaſs diſh underneath: the acid thus obtained is called, from the ſhape of the veſſel that has been generally uſed for condenſing the fumes, ſpirit or oil of ſulphur by the bell. The quantity of acid collected by this proceſs is very ſmall, greateſt part of the fumes eſcaping: ſixteen ounces of ſulphur, in the moſt favourable circumſtances, yield ſcarcely one ounce of phlegmatic ſpirit; though it is certain, that out of this quantity of ſulphur, more than fifteen ounces are pure acid, of ſuch ſtrength as to require being diluted with above an equal quantity of water to reduce it to the pitch of common ſpirit of ſulphur; ſo that if ſulphur could be burnt without the loſs of any of its fumes, we might obtain double its weight of an acid of the ordinary ſtrength. The proceſs has lately been improved, by ſome particular perſons, though not perhaps to this degree, yet ſo far as to afford at a very low price almoſt all the acid now ſold under the name of oil of vitriol. The improvement conſiſts in burning the ſulphur in very large glaſs veſſels, in the bottoms of which ſome warm water is placed, whoſe ſteam ſerves to collect and condenſe the fumes; and in mixing with the ſulphur a ſmall portion of nitre, which enables it to burn without communication with the atmoſphere.

The acid of vitriol or ſulphur, largely diluted ſo as to be ſupportable, or be gratefully tart to the palate, is the moſt ſalubrious of all the mineral acids. It is mixed with watery infuſions, ſpirituous tinctures, and other liquids, as an antiphlogiſtic; as a reſtringent in hemorrhages; and as a ſtomachic and corroborant in weakneſſes, loſs of appetite, and decays of conſtitution, accompanied with ſlow febrile ſymptoms, brought on by irregulari-

ties, or ſucceeding the ſuppreſſion of intermittents by Peruvian bark. In ſeveral caſes of this kind, after bitters and aromatics of themſelves had availed nothing, a mixture of them with the vitriolic acid has happily taken place: the form commonly made uſe of is that of a ſpirituous tincture: ſix ounces of oil of vitriol are dropt by degrees into a quart of rectified ſpirit of wine, the mixture digeſted for three days in a very gentle heat, and afterwards digeſted for three days longer with an ounce and a half of cinnamon, an ounce of ginger, and half an ounce of the dry leaves of pepper-mint; or a pint of an aromatic tincture drawn with proof ſpirit is mixed with four ounces of the ſtrong acid: theſe liquors are given from ten to thirty or forty drops, in any convenient vehicle, at ſuch times as the ſtomach is moſt empty. A mixture of oil of vitriol with ſpirit of wine alone, in the proportion of one part of the former to three of the latter, digeſted together for ſome time, is uſed in France as a reſtringent in gonorrhœas, female fluors, and ſpittings of blood.

When oil of vitriol and rectified ſpirit of wine are long digeſted together or diſtilled, a part of the acid unites with the vinous ſpirit into a new compound, very volatile and inflammable, of no perceptible acidity, of a ſtrong and very fragrant ſmell, and an aromatic kind of taſte: this dulcified part, more volatile than the reſt, ſeparates and riſes firſt in diſtillation, and may thus be collected by itſelf. The college of London directs a pound of oil of vitriol and a pint of rectified ſpirit of wine to be cautiouſly and gradually mixed, a great conflict and heat enſuing if they are mixed haſtily, and ſet to diſtil with a very gentle heat: that of Edinburgh orders the ſame quantity of the oil of vitriol to be dropt into four times as much of the vinous ſpirit, and the mixture to be digeſted in a cloſe veſſel, for eight days, previouſly to the diſtillation, with a view to promote the coalition of the two ingredients. The different proportions of the acid ſpirit to the vinous, in theſe preſcriptions, make no material variation in the qualities of the product, provided the diſtillation is duly conducted; for the ſmalleſt of the above proportions of acid is much more than the vinous ſpirit can dulcify, and all the redundant acid remains in either caſe behind. The true dulcified ſpirit riſes in their ſubtile vapours, which condenſe upon the ſides of the recipient in ſtraight ſtriæ: theſe are ſucceeded by white fumes, which form either irregular ſtriæ, or large round drops like oil; on the firſt appearance of which, the proceſs is either to be ſtopt, or the receiver changed. The ſpirit which theſe fumes afford, very different from the dulcified one, has a pungent acid ſmell like the fumes of burning ſulphur: on its ſurface is found a ſmall quantity of oil, of a ſtrong penetrating and very agreeable ſmell, readily diſſoluble in ſpirit of wine, to a large proportion of which it communicates the ſmell and taſte of the aromatic or dulcified ſpirit. The college of Edinburgh, in order to ſecure againſt any acidity in the dulcified ſpirit, order it to be rectified, by mixing it with an equal meaſure of water, in every pint of which a dram of ſalt of tartar has been diſſolved, and drawing off the ſpirit again by a gentle heat.

This ſpirit, taken from ten to eighty or ninety drops, ſtrengthens the ſtomach and digeſtive powers, relieves flatulencies, promotes urine, and in many caſes abates ſpaſmodic ſtrictures and procures reſt. It is not eſſentially different from the celebrated mineral anodyne liquor of Hoffman; to which it is frequently, by the author himſelf, directed as an alternative. It is evident, from Hoffman's writings, that his anodyne was compoſed of the dulcified ſpirit and the aromatic oil which comes over after it, but the particular proportions of the two he has no where ſpecified: the faculty of Paris directs, under the title of his preparation, twelve drops of the oil to be diſſolved in two ounces of the ſpirit; the college of Wirtemberg ſeems to think, that all the oil and all the ſpirit, obtained in one operation, were mixed together, without regard to the preciſe quantities.

The dulcified ſpirit is ſometimes uſed as a menſtruum for certain reſinous and bituminous bodies, which are more difficultly and languidly acted upon by pure vinous ſpirits. It is often mixed with aromatic and ſtomachic tinctures, in caſes where the ſtomach is too weak to bear the acid elixirs abovementioned: eight ounces are commonly added to a pint of the officinal aromatic tincture, in which it does not, like the acid undulcified, occaſion any precipitation. A medicine of this kind was formerly in great eſteem under the name of Vigani's volatile elixir of vitriol, the preparation of which was long kept a ſecret, and firſt made public in the *Pharmacopœia Reformata*: it is prepared by macerating, in ſome dulcified ſpirit of vitriol free from acidity, a ſmall quantity of mint leaves curiouſly dried, till the ſpirit has acquired a fine green colour: to prevent the neceſſity of filtration, during which the more volatile parts would exhale, the mint may be ſuſpended in the ſpirit in a fine linen cloth.

If the dulcified ſpirit, rectified as above preſcribed from a ſolution of fixt alcaline ſalt, be ſhaken with equal its quantity of a like ſolution, and the mixture ſuffered to reſt; an ethereal fluid riſes to the ſurface, and great part of the dulcified ſpirit may be recovered again from the remainder by diſtillation. We are informed by Dr. Hadley, that he has obſerved the largeſt proportion of ether to be obtained, by uſing the ſtrongeſt vitriolic acid of the ſhops with twice its quantity of ſpirit of wine, and diſtilling immediately by a heat ſufficient to make the mixture boil; and that by this management, from three pounds of oil of vitriol and ſix pints of rectified ſpirit of wine, he obtained two pints and a half of the ether.

The ether or ethereal ſpirits is the lighteſt, moſt ſubtile, volatile, and inflammable, of all known liquids: it quickly exhales in the air, diffuſing an odour of great fragance: it does not mingle with water, with acid liquors, with alcaline liquors, or with vinous ſpirits, but diſſolves oils, balſams, and reſins, and extracts the oily and reſinous parts of vegetables. It has been hitherto regarded chiefly as a matter of curioſity, nor are its medicinal qualities as yet much known. Malouin looks upon it as one of the moſt perfect tonics, friendly to the nerves, cordial and anodyne; and ſays he has found it to be a good remedy in rheums, for abating coughs, eſpecially thoſe of the convulſive kind. Its great volatility renders the taking of it very incommodious: the author abovementioned orders, as the moſt convenient form, from three to twelve drops to be dropt on ſugar or powdered liquorice, a little warm water or ſome warm infuſion to be immediately added, and the whole ſwallowed directly. It has been reported to give immediate eaſe in violent head-achs, by being rubbed on the temples.

The vitriolic acid ſaturates a larger quantity of fixt alcaline ſalts than any of the other acids, and diſlodges therefrom ſuch other acids as have been previouſly combined with them: of the ſtrong ſpirit or oil of vitriol, about five parts are ſufficient for eight of the common vegetable fixt alcalies. The neutral ſalt, reſulting from its coalition with this kind of alcali, is of a bitteriſh taſte, very difficultly ſoluble in water, and ſcarcely fuſible in the fire: in ſmall doſes, as a ſcruple or half a dram, it is an uſeful aperient; in larger ones, as four or five drams, a mild cathartic, which does not paſs off ſo haſtily as the ſal catharticus, and ſeems to perform its office more thoroughly. This ſalt has been commonly prepared with the alcali obtained from tartar, and is hence called vitriolated tartar: ſome dilute the oil of vitriol with an equal quantity of warm water, and drop into it a ſolution of the alcaline ſalt till a freſh addition occaſions no further efferveſcence: others, inſtead of the pure acid, uſe vitriol in ſubſtance, which being diſſolved in boiling water, any alcaline ſalt, gradually ſuperadded till the efferveſcence ceaſes, abſorbs the pure acid, and throws down the metallic baſis of the vitriol; one part of the alcali is nearly ſufficient for two of the vitriol: this laſt method, more troubleſome than the other in regard to the preparation, more effectually ſecures the medicine from a redundance of acidity. The wholeſale dealers ſubſtitute for this ſalt that which remains after the extraction of the acid of nitre by means of oil of vitriol, which when duly prepared, is exactly the ſame: but as they commonly employ in that proceſs an over-proportion of the vitriolic acid, and vend the remaining ſalt uncryſtallized, we often meet with it ſo very acid as to be utterly unfit for uſe.

With

With the mineral fixt alcali, and the earth called magnesia, this acid forms compound salts of a bitterer taste, somewhat less purgative, and much easier of solution, than that with vegetable alcalies: with volatile alcalies a very pungent ammoniacal salt, whose medicinal effects are not well known. The strong acid, boiled on argillaceous earths to dryness, corrodes a portion of them, and concretes therewith into an austere styptic salt. Calcareous earths it does not dissolve into a liquid state, but may be combined with them, by precipitation from other acids, into an indissoluble concrete seemingly of no medicinal activity. Among metallic bodies, it dissolves zinc and iron readily; copper, silver, quicksilver, lead, and tin, very difficultly: it is fitted for acting on the two first by dilution with three or four times its quantity of water: the others require the undiluted acid, and a heat sufficient to make it boil; when, the more phlegmatic parts exhaling, so much of the pure acid matter remains combined with the metals, as to render them, in part at least, dissoluble in water.

The medical qualities of the acid in its volatile state are very little known, and those of the combinations thereof with alcalies not at all, though they should seem to deserve enquiry. The volatile acid of burning brimstone may be commodiously transferred into fixt alcalies, by dipping linen clothes in a strong solution of the alcali, and suspending them over the fumes, of which they will quickly imbibe so much as to neutralize the alcali: this neutral salt being rubbed off, the clothes may be again moistened with the alcaline ley, exposed to the acid fumes, and these processes alternately repeated. The neutral salt thus obtained differs greatly in its taste and other properties, and doubtless also in its medical virtues from that which is produced by the coalition of the fixt acid with the same alcali, that is from vitriolated tartar. It dissolves more easily in water, and shoots, not into octangular crystals, but into small slender ones like short needles. On adding to it the fixt vitriolic acid, or even the weaker acids of nitre or sea-salt, the volatile acid is disengaged from the alcali, and though, in the compound salt, its pungent smell was wholly suppressed, it now rises in distillation as pungent and suffocating as the original fumes of the brimstone. The neutral salt, in a dry form, may be kept unchanged for years: dissolved in water and exposed for some time to the air, or if roasted with a gentle heat, it becomes the same with vitriolated tartar.

VITRIOL *of Copper*. The glass-makers have a method of making this without corrosives, which was originally practised by Neri, and with which they make very fine colours in glass, particularly a fine sea-green.

The method of making the preparation is this: take little thin pieces of brass, and lay them stratum super stratum in a crucible, with powder of brimstone. When the vessel is full, set it luted and covered in an open wind furnace, with burning coals over it, and let it stand two hours, then let the furnace cool of itself, and take out the crucible; the mass within will be of a blackish obscure purple; powder and sift it fine, and then, mixing with every pound of it six ounces of powdered brimstone, take a round vessel of earth that will bear the fire, place it upon iron bars set across in an open wind furnace, fill it with coals, and then put in the powder; keep it burning and stirring about till all the brimstone is burnt up; then take out the pan, and powder the calcined mass again, sift it fine, and proceed with it thrice as before; the last time let it stand on the fire till it become red. Put a pound of this calcined copper into a glass body, with six pints of water; evaporate two pints or thereabouts in a sand heat; the water is then of a fine blue, and must be poured off clear; then filtrate it. Evaporate the water from the remaining sediment of copper left in the glass, and with new sulphur calcine it again and again; repeat this five or six times, and extract the blue tincture with water as before; filtrate all the waters, and put them together. Evaporate all to a fifth part or thereabouts, and set it in a cool place, and fine pointed crystals will be formed, resembling emeralds; separate these crystals, and evaporate the water again, till all the crystals be procured. Then put a pound of them into a glass retort, well luted and fitted to a capacious receiver; let the joints be well closed, and make a moderate fire for four hours; then make it violent for twenty hours, or till no more white fumes arise. The next day open the receiver, and separate the liquor into a glass, where it must be kept carefully sealed up. *Neri's Art of Glass.*

VITRIOLATED, among chemists, something that has vitriol infused in it.

VITRIOLIC, an appellation given to whatever abounds with, or partakes of, the nature of vitriol: thus such fossile bodies as contain vitriol, are called vitriolic minerals, or ores of vitriol; as the pyrites, chalcitis, misy, sory, melanteria, marcasites, &c.

VITRIOUS, or VITREOUS *Humour of the Eye.* See VITREOUS.

VITTA, in anatomy, that part of the amnios, which sticks to an infant's head, when just born.

VITUS's DANCE, *Chorea Sancti Viti*, in medicine, a sort of convulsion, which boys and girls are subject to, from the age of ten years, to the time of puberty: it discovers itself first by a kind of lameness, or an instability of one of the legs, which they draw after them in a ridiculous manner; nor can they hold the arm of the same side still for a moment; and before they can bring a cup to their mouth, they use a thousand odd gesticulations. In a convulsive paroxysm, the limbs are strongly agitated; the hands are sometimes put behind them, and soon after they seem to be beating the air; and their legs will be drawn hither and thither, as if they were dancing some antic dance. See CONVULSION and SPASM.

Dr. Mead thinks this disorder to be rather paralytic than convulsive, and that it may be cured by use of cold baths, and chalybeate medicines. Sydenham's method of cure is this: first take off seven or eight ounces of blood, more or less according to the strength of the patient, from the arm; and the next day, let the patient take a gentle purge of rhubarb, sena, manna, &c. In the evening of the same day, let him take a draught, with a scruple of Venice-treacle, and eight drops of liquid laudanum mixed in honey and milk-water. This purging and opiate draught is to be repeated at some days distance; the bleeding is also to be repeated to the fourth time; and in the intermediate days, a cordial and nervous electuary is to be given, composed of the conserves of rosemary, orange-peel, and Roman-wormwood, with Venice-treacle, candied nutmeg, and candied ginger; of this, the bigness of a nutmeg may be given every morning and afternoon, drinking after it a decoction of piony, master-wort, and elecampane, and angelica-roots, the leaves of rue, sage, betony, and other cephalic plants, with orange peel and juniper-berries. Spirit of hartshorn may also be given every night in small doses, in a nervous julep, and plasters of gum-caranna may be applied to the soles of the feet. According as the cure advances, the patient recovers the use of his hand and foot; and his amendment may always be discovered by letting him attempt to bring a glass of any liquor to his mouth in a strait line: though the bleeding should not be repeated beyond the fourth time, yet the alterative and purging medicines should be continued till the patient is quite well; and as people are subject to relapses in this disorder, it is proper to give the same medicines, and to bleed at the return of that season of the year.

VIVA VOCE, a Latin phrase frequently used in English writers, and literally signifying by word of mouth.

VIVIFICATION, in medicine, the art of vivifying; that is, of contributing to the action that gives life, or maintains life.

The chemists, also, use the word in speaking of the new force, vigour, and lustre, which, by this art, they give to natural bodies; particularly to mercury, which, after having been fixed or amalgamated, they restore to its first state.

VIVIPAROUS, *viviparus*, in natural history, an epithet applied to such animals as bring forth their young alive and perfect, in contradistinction to them that lay eggs, which are called oviparous animals.

The

The females of all the quadruped claſs are viviparous, and thoſe of the bird claſs are all oviparous. The laws of nature in the larger animals, are therefore, in a great meaſure, fixed and certain, but it is not ſo in the inſect tribes, nor in the fiſhes; for of theſe ſome are viviparous, and others oviparous; and thoſe of genera nearly allied to one another. Among inſects, the much greater number are oviparous; but there are many which are not ſo, as the pucerons, progallinſects, cochineal, &c. The millepedes and ſcorpions are alſo well known to be ſo; all the females of the butterfly, and of ſome other claſſes, lay only eggs; but the moſt ſingular and remarkable inconſtancy in nature, if we may be allowed the expreſſion, is that in the fly kingdom; the ſame claſs of inſects, and even the ſame genus, will furniſh us with ſome which are viviparous, and others which are oviparous; the two-winged flies give us inſtances of this: but theſe are not ſingle in that reſpect; for among the reptile world, there are other creatures which are ſubject to the ſame varieties; and Swammerdam has obſerved a viviparous ſnail. The two winged viviparous flies bring forth worms in all reſpects the ſame with thoſe hatched from their eggs in the other ſpecies.

VIVO, in architecture, the ſhaft or fuſt of a column.

The term is alſo uſed in a more particular ſenſe for the naked of a column, or other part.

ULCER, *Ulcus*, in ſurgery, is a ſolution of the ſoft parts of our bodies, together with the ſkin, produced by ſome internal cauſe, as an inflammation, abſceſs, or acrimonious humours. But wounds which become inveterate, and even contuſions, when difficult of cure, come within this definition, and paſs, at length, into ulcers, and are commonly ſo called.

The proper and uſual ſeat of an ulcer, then, is in any of the ſofter parts of the body, as the ſkin, fat, glands, fleſh, and internal viſcera. For if there be any exulceration or corroſion in the harder parts, as the bones, it comes rather under the notion of a caries, or what is commonly called ſpina ventoſa, than that of an ulcer; though, on account of ſome kind of reſemblance which it has with the ulcer, or eroſion, of the ſofter parts, they are ſometimes treated of in conjunction.

Ulcers can by no means be reckoned all of one kind, but are diſtinguiſhed into various ſpecies, on many accounts; as, 1. With reſpect to the different parts of the body in which they are ſeated; for, ſometimes they infeſt the ſkin, at other times the fat, and ſometimes the glands and fleſh.

2. As to their magnitude; for ſome ulcers are large and extended, others ſmall, and contracted within narrow limits; ſome deep, others ſhallow, and more ſuperficial: in particular, ulcers of a conſiderable depth, but narrower, and more eſpecially diſtinguiſhed by the narrowneſs of their orifice or beginning, uſually paſs under the peculiar denomination ſinus or fiſtula. Ulcers differ,

3. With regard to duration; for ſome are recent, others inveterate.

4. On account of their attendant ſymptoms; in which reſpect ſome ulcers are mild and favourable, others malignant, that is, attended with very acute pains, or fœtid, putrid, pinguious, rheumy, or diſcharging much ichor, creeping or ſpreading, cancerous, or inclining to a cancer, callous, fiſtulous, or verminous; there is a difference between them.

5. With reſpect to their cauſes, in which light they aſſume the epithets of ſcorbutic, venereal, carious, cancerous, peſtilential, and ſuch as are ſuppoſed to proceed from faſcination. In the laſt place, ulcers are diſtinguiſhed by the parts in which they are ſeated. Thus, ſome infeſt the noſtrils, others the fauces, palate, breaſts, and anus; and one ſort has the name of fiſtula lacrymalis.

The method of cure in ulcers is extremely various, as adapted to the great variety of the diſeaſe; for when the ulcer is but recent, it is to be healed in the ſame manner as a recent wound or abſceſs. We muſt firſt, then, begin with mundification, or cleanſing the ulcer; after that proceed to incarn, or fill the cavity with new fleſh; and, laſtly, cover and conglutinate the ſame as much as poſſible, with a fair and even cicatrix.

Mundification of an ulcer is, according to Heiſter, uſually performed in the following manner: firſt, the corrupted matter is evacuated; or, when it diſcharges itſelf not ſo freely as it ought, gently expreſſed with the fingers; if there be a deep ſinus belonging to the ulcer, it is to be exterged by ſome proper injections; or, if the place be open enough, by repeating intromiſſions of freſh lint. If there be any pieces of membranes, or other corrupted pinguious parts, left in the ulcer, the beſt way to eject them is, at every dreſſing, to introduce into the place lint moiſtened with ſome digeſtive ointment, and cover it with a plaſter of diachylon, diapalma, or ſomething of the like nature; and upon that, apply compreſſes, and over the whole a bandage: this method is to be carefully followed till the place be thoroughly cleanſed, or till the bottom of the ulcer appears quite red, and covered with new fleſh.

After due mundification, the next buſineſs is to fill the ulcer with new fleſh, which is performed by the help of ſuch medicines as are commonly called ſarcotics.

The beſt and moſt effectual, by many degrees, is the digeſtive ointment; for without ſome extraordinary impediment, this digeſtive is, of itſelf, ſufficient to produce new fleſh. It is, indeed, the manner of almoſt all ſurgeons very gravely to recommend every one his proper balſamics for the procuring of new fleſh; but it is preſumed, there is no neceſſity for them to be ſo careful and ſolicitous in this point, ſince there is, in this very digeſtive, a balſamic virtue; and it ought, beſides, to be conſidered, that this new fleſh owes its generation, not ſo much to the aſſiſtance of medicines, as the benefit of nature: for all the care and diligence of the ſurgeon have ſcarce any other effect, than to remove all ſuch things as are hurtful, and may prove impediments to a cure. If any one, however, ſhould think this digeſtive ointment not ſtrong enough for his purpoſe, he may try balſam of Arcæus, balſam of Peru, balſam of Mecca, balſam of ſulphur, eſſence of myrrh and aloes, oil of myrrh per deliquium, oil of eggs, and other vulnerary balſams of the like kind, which may be uſed in its ſtead; and, by the beſt means he can procure, to accompliſh a perfect conglutination.

When an ulcer has penetrated ſo deep as to have its bottom remote, not only from ſight, but from the reach of medicines, it may ſeem neceſſary in every dreſſing, after expreſſing the corrupted matter collected within, to make an injection of ſome cleanſing and healing liquor; ſuch as a decoction of agrimony and birthwort mixed with honey of roſes, or eſſence of myrrh and aloes, or what Belloſte, in his Hoſpital Surgeon, recommends, a decoction of walnut leaves mixed with ſugar before the place be bound up, till the bottom is conglutinated, and to continue the ſame till the ulcer is filled up.

The ulcer being, by ſome means or other, as may ſeem moſt adviſeable, incarned and filled up, the induction of a fit and decent cicatrix muſt be completed; but if by ſuch means you cannot prevent a luxuriancy of fleſh, with a moiſtneſs of the ulcer, it will be proper to ſprinkle on the part ſome drying powders, ſuch as thoſe of maſtic, frankincenſe, ſarcocolla, colophony, lapis calaminaris, and tutty; applying, afterwards, to the place dry lint, and a plaſter accommodated to retain and hold together all the things applied, continuing the ſame till the place be perfectly whole and ſound: but if the luxuriant and fungous fleſh has already elevated itſelf above the reſt, above the ſkin, the beſt way to conſume it, is to rub it with blue vitriol; or, if this be not ſtrong enough, to ſprinkle on it ſome powder of red precipitate and burnt alum, till its growth be entirely ſuppreſſed, and nothing appears prominent.

In the laſt place, it is hardly to be expreſſed how much a prudent regimen in diet and manner of living contributes towards the incarning and conglutination of ulcers: for it has been an old obſervation of the profeſſors of the ſalutary art, that very bad ulcers have been cured by means of a regimen, without any conſiderable aſſiſtance from medicine; and, on the contrary, that the ſlighteſt and moſt contemptible ſores have, by a neglect of the rules of diet, and prepoſterous way of living, degenerated into very bad, and even incurable, ulcers.

Great care, therefore, is to be taken by every perſon troubled with an ulcer, to avoid ſalt, acrid and acid food, and ſuch as is too fat or heating, with ſwine's fleſh, and all ſuch as is difficult of concoction. If a bad habit of body be an impediment to the cure of an ulcer, the advice of a ſkilful phyſician is required, who, by the preſcription of proper internal medicines, may not only prevent an ulcer of a mild and favourable kind from becoming malignant, and perhaps incurable, but as much as poſſible promote and haſten its cure.

In callous and fiſtulous ulcers, that have formed variety of ſinuſes, and when either nothing can be done by corroſive medicines, or elſe that they tear and corrode the nerves, and bring on convulſions, and other bad ſymptoms, before they affect the callus; in theſe caſes, the beſt and ſafeſt way is to lay open the ſinus, taking care not to wound the nerves, tendons, and arteries; and, after that, all the calluſes may be eaſily deſtroyed by the common methods. Or, if even this method ſhould not have the deſired effect, and if the patient has a conſiderable ſhare both of ſtrength and courage, and the ſituation of the nerves and arteries is favourable, the callous parts muſt be all either entirely cut out with the knife, or burned away by the actual cautery.

When ulcers are attended with a large diſcharge, the acrimonious ſerum, wherewith the blood abounds, ſhould be evacuated by cathartic and diuretic medicines. Millepedes, in any form, are very properly preſcribed to be taken internally in theſe, as are alſo the eſſence of amber, myrrh, balſam of Peru, tincture of ſalt of tartar, tartarized tincture of antimony, and the like: large and frequent draughts of ſmall liquors are frequently the cauſe of theſe diſorders, and are therefore moſt carefully to be avoided; ſtrong ale, or old wine, ſhould be drank ſparingly at meals, and nothing between them. Such meats are beſt, on theſe occaſions, as have feweſt juices in them, and are very well roaſted; and the external medicines muſt be thoſe which have the greateſt reputation as dryers. The principal of theſe are lime-water, lapis calaminaris, tutty, chalk, maſtic, frankincenſe, colophony, and native cinnabar; and when any of theſe have been ſprinkled in fine powder upon the ulcer, a plaſter of diapompholygos, or the like, is to be laid over it.

For the cleanſing venereal ulcers, Heiſter recommends the phagedenic water; or lime-water, impregnated with calomel: either of theſe may be applied often every day, and the parts may alſo, if neceſſary, be touched with the cauſtic; and when they are thoroughly cleanſed, they may very ſucceſsfully be healed, either with an ointment made only of crude mercury mixed with turpentine, or with the following: take of the diapompholygos-ointment and crude mercury, killed with a ſmall quantity of Venice turpentine, of each equal quantities; mix them in a glaſs mortar into an ointment: or, take of the amalgama of lead and tin an ounce, of bole armenic two ounces; mix theſe, and make them into an ointment by mixing with them a ſufficient quantity of ointment of roſes, or any other ſimple ointment, in a glaſs-mortar. If there be at the ſame time a caries of the bone, which is, indeed, too frequently the caſe, this is to be dreſſed with euphorbium, oil of cloves, phagedenic-water, or ſpirit of nitre with quickſilver diſſolved in it; or, if it can conveniently and ſafely be done, the actual cautery is of ſignal ſervice.

ULCERATION, or EXULCERATION, in ſurgery, a little hole in the ſkin, cauſed by an ulcer.

ULIGINOUS, in agriculture, an appellation given to a moiſt, mooriſh, and fenny ſoil.

ULLAGE, in gauging, is ſo much of a caſk, or other veſſel, as it wants of being full. See GAUGING.

ULMUS, the elm, in botany. See ELM.

ULNA, in anatomy, one of the bones of the forearm, reaching from the elbow to the wriſt: it is big at its upper extremity, and grows gradually ſmaller towards its lower end.

This bone is longer than the radius, and has a motion of flexion and extenſion: at its upper extremity, it articulates with the os humeri and the criſta of the radius; and its lower extremity articulates with the carpus, as alſo with the radius by means of a criſis.

ULNA, an ell. See the articles ELL and MEASURE.

ULNARIS, in anatomy, the name of two muſcles of the carpus, or hand; one called ulnaris internus, which is a flexor muſcle terminating in the internal oſſicle of the carpus; and the other, called ulnaris externus, is an extenſor muſcle, terminating in the metacarpal bone that ſupports the little finger.

ULTERIOR, in geography, is applied to ſome part of a country or province, which, with regard to the reſt of that country, is ſituated on the farther ſide of the river, mountain, or other boundary, which divides the country into two parts. Thus Africa, with regard to Europe, is divided, by mount Atlas, into Citerior and Ulterior, i. e. into two portions, the one on this ſide mount Atlas, and the other on that.

ULTRAMARINE, *Ultramarinum*, a beautiful blue colour uſed by the painters, prepared from lapis lazuli, by calcination. See LAZULI.

The German lapis lazuli does not anſwer well in this proceſs, and diſcovers itſelf by its calcining eaſier than the African or Aſiatic, and turning greeniſh. The oriental kind calcines to a finer blue than it naturally has, and retains the colour for ever.

After calcining the ſtone in a clear fire of charcoal, they grind it to an impalpable powder on a porphyry, and then mixing it up in a paſte, compoſed of pitch, wax, and oil, they work it about with the hands; and, finally, kneading this in a veſſel of clear water, as the powder ſeparates from the viſcid matter, it ſinks to the bottom: when all that is perfectly fine in this, is worked out, they let the water be drained off, and dry the powder for uſe. What remains embodied in the paſte, is afterwards ſeparated, and makes a worſe kind than the former; though even the very meaneſt ultramarine is a very beautiful colour.

Ultramarine muſt be choſen of a high colour, and well ground, which may be known by putting it between the teeth, and if it feel gritty, it is a ſign it has not been well ground.

To know whether it be pure and unmixed, put a little of it into a crucible, and heat it red-hot; and if the powder has not changed its colour after this trial, it is certainly pure; on the contrary, if there be any change, or any black ſpecks in it, then it has been adulterated.

There is alſo a ſpurious ſort, called common or Dutch ultramarine; which is only ſmalt well groun and pulverized. See SMALT.

ULTRAMONTANE, ſomething beyond the mountains. The term is principally uſed in relation to Italy and France, which are ſeparated by the mountains of the Alps.

ULTRAMUNDANE, *Ultramundanus*, beyond the world; is that part of the univerſe ſuppoſed to be without, or beyond, the limits of our world, or ſyſtem.

ULVA, in botany, a genus of water-plants, belonging to the cryptogamia claſs; the fructifications of which are diſpoſed in membranous bladders, without the leaf.

UMBEL, *Umbella*, among botaniſts, is the extremity of a ſtalk or branch divided into ſeveral peduncles, or rays, beginning from the ſame point, and opening in ſuch a manner as to form an inverted cone: theſe are either ſimple or compound; a ſimple umbel, is when the receptacle is but once divided into foot-ſtalks; but, a compound umbel, is when all the common footſtalks are ſubdivided into umbellulæ, or little umbels. They are of different figures; as plane, convex, concave, or radiated.

UMBELLIFEROUS PLANTS, are thoſe whoſe flowers are produced in an umbel, on the top of the ſtalks, ſomewhat repreſenting an umbrella.

All the plants of this kind belong to the pentandria claſs of Linnæus; the flower is pentapetalous, and ſucceeded by two naked ſeeds, joined together. Thoſe which grow wild in dry ſoils, are aromatic, warm, reſolvent, and carminative; but thoſe which grow in moiſt places are often poiſonous: the virtue is chiefly in the roots and ſeeds; ſuch are fennel, parſley, parſnips, carrots, hemlock, &c.

UMBER, or UMBRE, *Umbria*, among painters, &c. a kind of dry duſky-coloured earth, which diluted with water, ſerves to make a dark brown colour, uſually called with us, a hair colour.

It is called umber, from *umbra*, a ſhadow, as ſerving chiefly for the ſhading of objects; or, rather, from Umbria, a country of Italy, whence it is uſed to be brought.

UMBILICAL, among anatomiſts, ſomething relating to the umbilicus, or navel. See the articles NAVEL and ABDOMEN.

UMBILICAL POINTS, in mathematics, the ſame with foci. See FOCUS.

UMBILICUS, the navel, in anatomy. See the article NAVEL.

UMBONE, a name uſed by ſome for the ſtyle or piſtil of a flower. See the articles FLOWER, PISTIL, &c.

UMBRA, or SHADOW. See SHADOW.

UMBRE, or UMBER, among painters. See the article UMBER.

UMBRELLA-TREE, in botany, a curious ſpecies of magnolia. It grows in Carolina to the height of ſixteen or eighteen feet; the trunk is ſlender, and the wood is ſoft and ſpongy; the leaves are large, deciduous, and produced in horizontal circles, reſembling an umbrella; whence the name: the flowers are compoſed of ten or eleven white petals, which hang down, and are afterwards ſucceeded by ſcarlet fruit of the ſame form with the other ſpecies of magnolia, and is increaſed from ſeeds in the ſame manner. See MAGNOLIA.

UMPIRE, a third perſon choſen to decide a controverſy left to arbitration. See the article ARBITRATION.

UNCASING, among ſportſmen, ſignifies the cutting up, or flaying of a fox.

UNCIA, in general, a Latin term denoting the twelfth part of any thing; particularly the twelfth part of a pound, called in Engliſh an ounce; or the twelfth part of a foot, called an inch.

UNCIÆ, in algebra, the numbers prefixed before the letters of the members of any power produced from a binomial, reſidual, or multinomial root. Thus, in the fourth power of $a+b$, viz. $a^4+4a^3b+6a^2b^2+4ab^3+b^4$, the unciæ are 4, 6, 4; being the ſame with what others call co-efficients. See BINOMIAL, INVOLUTION, and CO-EFFICIENT.

UNCIAL, an epithet which antiquaries give to certain large fized letters or characters, anciently uſed in inſcriptions and epitaphs. The word is formed from the Latin *uncia*, the twelfth part of any thing, and which in geometrical meaſure ſignified the twelfth part of a foot, viz. an inch, which was ſuppoſed to be the thickneſs of the ſtem of one of thoſe letters.

UNCTION, *Unctio*, the act of anointing or rubbing with oil, or other fatty matter.

The cure of divers wounds, ulcers, &c. greatly depend upon repeated unctions with oil, unguents, cerats, &c. For the mercurial unction applied to bring on a ſalivation, ſee SALIVATION.

UNCTION, in matters of religion, is uſed for the character conferred on ſacred things, by anointing them with oil.

Unctions were very frequent among the Hebrews.—They anointed both their kings and high-prieſts, at the ceremony of their inauguration. They alſo anointed the ſacred veſſels of the tabernacle and temple, to ſanctify and conſecrate them to the ſervice of God. The manner of making the oil, or perfumed ointment, with which the prieſts, and the veſſels of the tabernacle, were to be anointed, was revealed to Moſes by God himſelf, who calls it "An holy anointing oil." The moſt exquiſite perfumes and balſams were ingredients in it. The ceremony of anointing and conſecrating Aaron to the high-prieſthood is recorded in ſcripture. The ſacred oil was poured upon his head and ran down upon his beard, and to the ſkirts of his garment. The Rabbins have a conceit, that the oil was poured upon his head in the form of a croſs, or of the Hebrew letter *Caph*. They add, that, as long as the ointment or perfume, compoſed by Moſes, laſted, they continued to anoint the ſucceeding high-prieſts therewith: but when that was all ſpent, they were only inſtalled by the ceremony of the habit, or inveſting them with the pontifical ornaments. And they ſay, the Moſaical unction laſted till the Babyloniſh captivity. But the Chriſtian writers are of opinion, that the unction of the high-prieſts continued to the coming of the true anointed, the Meſſiah. And it ſeems as if Moſes intended its continuance, by his ſetting down ſo punctually the manner of its compoſition.

In the ancient Chriſtian church, unction or anointing always accompanied the ceremonies of baptiſm and confirmation. Perſons to be baptized were anointed with oil, before they went into the water. This unction was performed by a deacon for the men, and by a deaconeſs for the women. The deſign of it was to prepare them for their ſpiritual combat, in like manner as the athletæ were anointed before they entered the liſts. After the baptized perſon came out of the water, he was again anointed with oil, as the completion and confirmation of baptiſm. This was adminiſtered by the biſhop, or ſome preſbyter acting by his authority.

Extreme unction, or the anointing of perſons in the article of death, was likewiſe practiſed by the ancient Chriſtians, in compliance with that precept of St. James: "Is any ſick among you? let him call for the elders of the church, and let them pray over him, anointing him with oil in the name of the Lord.".

The Romiſh church has advanced extreme unction to the dignity of a ſacrament. It is adminiſtered to none but ſuch as are afflicted with ſome mortal diſeaſe, or are in a decrepit age. It is refuſed to impenitent perſons, as alſo to criminals ſentenced to die, becauſe they are not in a ſtate of death by diſeaſe or any other infirmity. The parts to be anointed are, the eyes, the ears, the noſtrils, the mouth, the hands, the feet, and the reins: but men only are anointed in the part laſt mentioned. The laity are anointed in the palms of the hands; but prieſts on the back of it, becauſe the palms of their hands have been already conſecrated by ordination.

When a dying perſon is to receive the ſacrament of extreme unction, the prieſt prepares ſeven balls of cotton, to wipe the parts anointed; ſome crumbs of bread, to rub his fingers with, water to waſh them, a napkin to wipe them, and a taper to light him during the ceremony. In entering the ſick perſon's apartment, he bids peace to the houſe, and, having ſet down the veſſel of holy oil on the table, he gives the dying perſon the croſs to kiſs. Then he ſprinkles him with holy water, and exhorts him to repentance and confeſſion of his ſins. Before the ceremony of anointing is performed, all the perſons preſent fall down upon their knees, and repeat the penitential pſalms and litanies. Then the unction is performed in this manner: the prieſt dips the thumb of his right hand, and ſometimes a little ſpatula, into the veſſel, and anoints therewith the above-mentioned parts in the form of a croſs. The clerk lights him with a conſecrated taper, and holds a baſon or diſh in which the pieces of cotton are laid. The prieſt begins with anointing the ſick man's eyes, ſaying, "May God, by his holy anointing, pardon you the ſins you have committed by the eyes." In like manner he proceeds to the other parts, carrying the form of words according to the part he anoints. The anointing being ended, the prieſt repeats ſome prayers, and, when he goes away, leaves a crucifix with the ſick perſon, that the ſight of the dying Saviour may adminiſter ſome conſolation to him.

UNCUTH, *Unknown*, is uſed, in the ancient Saxon laws, for him that comes to an inn gueſt-wiſe, and lies there but one night, in which caſe his hoſt is not bound to anſwer for any offence he committed, of which he was guiltleſs himſelf.

UNDECAGON, is a regular polygon, of eleven ſides. See POLYGON.

UNDE', UNDEE, or UNDY. See WAVY.

UNDER *the Sea*, in the ſea-language. A ſhip is ſaid to be ſo when ſhe lies ſtill, or waits for ſome other ſhips, with her helm laſhed, or tied up a-lee.

UNDER CURRENTS, currents diſtinct from the upper or apparent currents of the ſeas.

Some naturaliſts conclude that there are in divers places under currents, which ſet or drive a contrary way from the upper current; whence they ſolve the remarkable phænomena of the ſea's ſetting ſtrongly through the Streights into the Mediterranean, with a conſtant current twenty leagues broad; as alſo, that running from the Euxine through the Boſphorus into the Helleſpont, and thence into the Archipelago: they conjecture, that there is an under current whereby as great a quantity is carried out as comes in. To confirm this, it is obſerved, that between the north and ſouth foreland, it is either high or low water upon the ſhore three hours before it is ſo off at ſea; a certain ſign, that though the tide of flood runs aloft, yet the tide of ebb runs under foot, or cloſe by the ground. Yet Dr. Halley ſolves the currents ſetting in at the Streights without overflowing the banks, from the great evaporation, without ſuppoſing any under current. See SEA.

UNDER *Chamberlain of the Exchequer*, an officer that clears the tallies written by the clerk of the tallies, and reads the ſame, in order that the clerk of the pell and the comptrollers thereof may ſee their entries to be true: he likewiſe makes all ſearches for records in the treaſury, and has the cuſtody of domeſday book.

UNDER *Treaſurer of England*, was an officer ſaid to be firſt created by king Henry VII. whoſe duty was to cheſt up the king's treaſure at the end of every term, to note the content of the money in each cheſt, and ſee it carried to the king's treaſury for the eaſe of the lord treaſurer.

UNDERSTANDING, *Intellectus*, is defined by the Peripatetics to be a faculty of the reaſonable ſoul, converſant about intelligible things, conſidered as intelligible. They alſo make it twofold, viz. active and paſſive. Active underſtanding, they hold that faculty of the ſoul by which the ſpecies and images of intelligible things are framed, on occaſion of the preſence of phantaſms or appearances thereof. For maintaining the intellect to be material, they hold it impoſſible it ſhould be diſpoſed to think by any diſproportionable phantaſms of mere body, and therefore that it is obliged to frame other proportionate ſpecies of itſelf, and hence its denomination active.

Paſſive underſtanding, is that which receiving the ſpecies framed by the active underſtanding, breaks forth into actual knowledge. See the article KNOWLEDGE.

The moderns ſet aſide the Peripatetic notion of an active underſtanding. The Carteſians define the underſtanding to be that faculty whereby the mind converſing with, and, as it were, intent on itſelf, evidently knows what is true in any thing not exceeding its capacity. The Corpuſcular philoſophers define the underſtanding to be a faculty expreſſive of things which ſtrike on the external ſenſes, either by their images or their effects, and ſo enter the mind. Their doctrine is, *nihil eſſe in intellectu quod non prius fuerit in ſenſu*; and to this doctrine Mr. Locke, and moſt of the lateſt Engliſh philoſophers, ſubſcribe. See IDEA.

Between the Carteſians and Corpuſcularians there is this farther difference, that the latter make the judgment to belong to the underſtanding, but the former to the will. Hence, according to the moſt approved opinion of the Corpuſcularians, the underſtanding has two offices, viz. perception and judgment; according to the Carteſians, it has only one, viz. perception. See the articles PERCEPTION, JUDGEMENT, and WILL.

UNDERSTANDING is alſo uſed for the act, exerciſe, or exertion, of this faculty, or the action whereby the mind knows things, or repreſents them in idea to itſelf.

UNDERTAKERS, were anciently ſuch perſons as were employed by the king's purveyors, and acted as their deputies. At preſent the name is chiefly uſed for upholders, or perſons who furniſh out funerals, and alſo for ſuch who undertake any great work.

UNDERWOOD, *ſub-boſcus*, is coppice, or any wood that is not accounted timber.

In the cutting the underwood of coppices, when the ſtubs are great, they ſhould be ſtubbed up, for they only take up a great deal of room, and ſend up few ſhoots, their cracks and holes letting in water, and uſually half killing them. The taking up theſe ſhould be performed in winter, and the ſpaces they leave will be ſoon occupied by young trees; if not, a long branch of ſome neighbouring tree may be laid down, and will ſoon ſend up a ſufficient ſupply of ſuckers for the place.

In ſelling the underwood, it is always proper to leave young trees enough. The worſt of theſe may be taken down the next fall, eſpecially if any of them grow near a great tree that will be fit to ſell the next ſeaſon, becauſe they may be ſpoiled by its fall. When trees are at their full growth, there are ſeveral ſigns of their decay, as the withering or drying of their top branches, their taking in water at ſome of their knots, their being hollow or diſcoloured, and their making but ſmall ſhoots. If wood-peckers make holes in the body, it is a bad ſign, and, according to the appearance of one or more of theſe ſymptoms, it is very proper to cut down the tree before it decays farther. Large and ſpreading trees in coppices are often of more miſchief than advantage, as they ſpoil a great deal of the underwood by their droppings.

The owner of a coppice muſt be very careful, when he ſells the wood ſtanding, by the acre, to mark beforehand what ſtandards are to be left, becauſe otherwiſe the purchaſer ſeldom fails to cheat him, by felling ſome of them. *Mortimer's Huſbandry.*

UNDULATION, in phyſics, a kind of tremulous motion or vibration obſervable in a liquid, whereby it alternately riſes and falls like the waves of the ſea.

This undulatory motion, if the liquid be ſmooth and at reſt, is propagated in concentric circles, as moſt people have obſerved upon throwing a ſtone, or other matter, upon the ſurface of a ſtagnant water, or even upon touching the ſurface of the water lightly with the finger or the like. The reaſon of theſe circular undulations is, that by touching the ſurface with your finger, there is produced a depreſſion of the water in the place of contact. By this depreſſion, the ſubjacent parts are moved ſucceſſively out of their place, and the other adjacent parts thruſt upwards, which lying ſucceſſively on the deſcending liquid, follow it; and thus the parts of the liquid are alternately raiſed and depreſſed, and that circularly. When a ſtone is thrown into the liquid, the reciprocal vibrations are more conſpicuous: here the water, in the place of immerſion, riſing higher by means of the impulſe, or rebound, till it comes to fall again, gives an impulſe to the adjoining liquid, by which means that is likewiſe raiſed about the place of the ſtone as about a center, and forms the firſt undulous circle; this falling again, gives another impulſe to the fluid next to it, farther from the center, which riſes likewiſe in a circle; and thus ſucceſſively greater and greater circles are produced.

Undulatory motion is likewiſe applied to a motion in the air, whereby its parts are agitated after the like manner as waves in the ſea; as is ſuppoſed to be the caſe when the ſtring of a muſical inſtrument is ſtruck. This undulatory motion of the air is ſuppoſed the matter or cauſe of ſound.

UNGELD, in our ancient cuſtoms, a perſon out of the protection of the law; ſo that if he were murdered, no geld or fine was to be paid, in the way of compenſation, by him that killed him.

UNGUENT, or OINTMENT, *Unguentum*, in medicine and ſurgery, a topical remedy or compoſition, chiefly uſed in the dreſſing of wounds and ulcers.

Unguents are divided into ſimple and compound, though it ſo happens that ſome of the former are conſiderably compounded; and amongſt the latter there are ſome ſimple unguents, and others very little compounded. Unguents, liniments, and cerates, are external forms applied on divers parts of the body, both to cure, to eaſe, and to relieve them. Theſe only differ from each other in their conſiſtence; with regard to which, unguents hold the medium, being ſtiffer than liniments, but ſofter than cerates. Oils are the baſes of all the three, to which are added wax, axungia, and ſeveral parts of

of plants, animals, and minerals, both on account of the virtues they furniſh, and to give a conſiſtence to the oils, and to keep them longer on the part, that they may have more time to act. See the articles CERATE and LINIMENT.

Any of the officinal plaſters, diluted with ſo much oil as will reduce it to the thickneſs of ſtiff honey, forms an ointment; but further increaſing the oil it becomes a liniment.

There are ſome conſiderable compoſitions of this form in the intention of emollients: and amongſt the compound unguents there are ſome which take in a number of very warm aromatic ingredients, and ſeem deſigned for paralytic infirmities, and caſes that require briſk attenuating applications. At the head of the emollient unguents, is the unguentum dialthææ; and among the attenuating ones, the moſt in eſteem is the unguentum martiatum and nervinum. There are ointments alſo within the intention of ſtrengtheners; and the next intention of any conſequence for which we are provided by this form, and which ſeems as ſuitable to it as any, is againſt cutaneous foulneſſes, as the itch, and ſuch like diſtempers; and this ſeems to be the reaſon that there is ſuch a choice of them now given. But though moſt of theſe have the reputation of great antiquity, and hold their places in abundance of officinal diſpenſatories down to the preſent, yet they are ſo uncleanly in uſe, that they are almoſt altogether fallen into neglect, unleſs in ſome of our hoſpitals; thoſe which contain mercury being much more neat and efficacious for the ſame purpoſe. Some other things of this diviſion are little elſe than oils wrought into ointments, by the exchange of oil for lard. Pomatums are alſo ranked among the number of unguents.

UNGUIS, a Latin term, ſignifying a nail of the hand or foot.

UNGUIS PANNUS, or PTERIGIUM, in medicine and ſurgery, a preternatural membrane formed upon the coats of the eye, ſo as to extend itſelf over the cornea and pupil, and obſtruct the ſight.

An unguis of the eye happens when the blood-veſſels of the tendinous tunic in the corners of the eyes are turgid with blood, through an obſtruction or inflammation. When this diſtemper encreaſes, there is a ſort of carnous web which covers the eye in whole or in part, inſomuch that the eyes are offended with the light, and look red ſometimes: the web is thin and white, ſometimes thicker and more fleſhy, rough, obſcure and painful; nay, ſometimes it becomes cancerous, which is incurable, and ought not to be touched. In the cure, this preternatural coat is to be removed or taken off by abſtergent and gently corroding medicines, or by the hand of a ſurgeon.

The medicines in uſe are ſugar-candy-honey, white wine, bone of the cuttle-fiſh, burnt hartſhorn, and calcined egg-ſhells; as alſo water of eye-bright, the great celandine, and the fennel, in which crocus metallorum may be infuſed: particularly the gall of pike diſſolved in a proper water; that is, two ounces to one of the gall. Some recommend a water diſtilled from the dung of young geeſe in April. If the diſorder be obſtinate, the juice of the greater celandine may be uſed diluted in fennel water. The following collyrium is proper: take of prepared lapis hæmatitis, half a ſcruple; of white vitriol, twenty-five grains; of myrrh and ſaffron, each five grains; of white ſugar candied, one ſcruple. Reduce this mixture to a powder, and then mix it with equal parts of the water of roſes, eye-bright, and fennel, and apply it to the eye with a feather, taking care not to injure the pupil. If theſe methods are inſufficient for deſtroying the pellicle, it muſt then be extirpated; in order to which, the patient being in a proper poſture, the ſurgeon takes the ſmall hook (plate CXXXVI. *fig.* 11.) and endeavours to paſs its point under the thickeſt and looſeſt part of the pellicle; and endeavours, by this means, to elevate it a little. In the next place he takes the needle *a* (*fig.* 12.) armed with a thread, and paſſing it under the pellicle, ties it with a double knot; and then faſtening the two ends in a loop, (*fig.* 13.) he thereby attempts to make a gentle elevation. This done, he endeavours to ſeparate the upper and lower margin of the membrane with a lancet, that he may afterwards cut off the reſt immediately in a ſtraight line near the lachrymal caruncle, by a pair of ſmall and ſtrait ſciſſars: he then draws back the thread and membrane towards the cornea; and if it adheres any where to the eye, frees it by degrees with a ſcalpel or ſciſſars; in doing which he muſt take care not to injure the cornea, and obſerve that no part of the membrane be left adhering to the eye, though it is better to have ſome part of the unguis adhering to the cornea, when the ſeparation is difficult, than to wound the cornea and leave ſcars in it; becauſe any ſmall portion of the membrane left behind may be taken off afterwards by heating the eye with gentle eſcharotics.

UNGUIS, in anatomy, is applied to two bones of the noſe, being as thin as ſcales, and reſembling the nail; whence their name.

The unguis are the ſmalleſt bones of the upper jaw, and are ſituated near the great canthus of the eyes. Some authors call them oſſa lacrymalia; others, orbitaria-oſſa. They are contiguous to four other bones, viz. the coronal; that of the noſe; the maxillary; and that part of the ethmoides which forms the orbit.

UNGUIS, among botaniſts, the narrow part where the petals are inſerted, when ſeveral go to make up the flower, as the broader part towards the end is called bractea.

UNGUIS ODORATUS, the nail-like ſweet ſhell, in pharmacy, a medicine famous among the ancients; but has, for a long time, been out of credit: and the conſequence of the neglect that has been ſhewn it is the loſing its real hiſtory, and the miſtaking different ſubſtances of the ſame origin and nature, though the produce of different animals, for it. We call what we ſuppoſe to be the unguis odoratus of the ancients, blatta byzantia; the truth is, however, that our blatta byzantia, or ſweet hoof, is not the ſame with the unguis odoratus of the antients, though nearly allied to it. The true unguis odoratus of the antients, is a thin, flat, teſtaceous ſubſtance, of an oblong or oval figure, rounded at both ends, and marked on the ſurface with three or four concentric circles, or oval lines: its colour is a duſky brown with ſome admixture of the orange, ſometimes of a purpliſh tinge: its uſual ſize is that of a full grown nail of a man's thumb, and its thickneſs about the ſame with that of the nail: it is tough, flexible, and elaſtic; and has no peculiar ſmell or taſte. Beſides this genuine unguis odoratus, they had another ſmaller kind: both are the opercula of ſhells of the murex kind frequent in the Red Sea. The blatta byzantia is alſo the operculum or cover of a murex, as well as the unguis odoratus; but it belongs to a different ſpecies of that genus: there are alſo two kinds of the blatta byzantia, which are naturally without ſmell and taſte.

UNGULA, in geometry, the ſection of a cylinder cut off by a plane paſſing obliquely through the plane of the baſe and part of the cylindric ſurface.

UNICORN, *μονοκερως*, an animal, famous among the ancients, but looked on by the moderns as fabulous, denominated from its diſtinguiſhing characteriſtic of having one horn only, which is repreſented as five palms long, and growing in the middle of the forehead. It is alſo ſaid to be about the ſize of a horſe: its hair ſhort, and of a darkiſh brown colour, very timorous, and therefore keeping moſtly in the woods. Some will have it an amphibious animal, and its horn moveable at pleaſure. Others make all its ſtrength to conſiſt in its horn; and add, that when purſued by the hunters, it precipitates itſelf from the top of the higheſt rocks, and pitches upon its horn, which ſuſtains the whole effect of its fall, ſo that it receives no damage thereby. It is added, that it is wonderfully fond of chaſte perſons; and therefore, in order to take it, a virgin is placed in its way, whom, when the unicorn ſpies, he lies down by her, lays his head in her lap, and falls aſleep; upon which, the virgin making a ſignal, the hunters come in and take the beaſt; which could never be caught by any other means, becauſe it would either caſt itſelf from a rock or die.

The unicorn is one of the ſupporters of the Britiſh arms. It is repreſented by heralds paſſant, and ſometimes rampant. When in this laſt action, as in the Britiſh arms, it is properly ſaid to be ſaillant. Argent, an unicorn ſejant ſable, armed and unguled, or, borne by the name of Harding.

UNICORN-FISH, in natural hiſtory, the name of a fiſh of the whale kind, remarkable for having a horn growing out at its noſe, in the manner of the ſuppoſed unicorn's horn, as deſcribed by many too credulous authors.

The fiſh feeds on fleſh, or other fiſh, and is not only found in the main ſea, but ſometimes gets up into large rivers. In the year 1636, there was a large one caught in the river Oſte, near its diſcharging itſelf into the Elbe, in the duchy of Bremen; this place is four German miles from the ſea. The ſkin of this fiſh was ſpotted with dark brown ſpots upon a white ground; the epidermis was tranſparent, and under it was another ſkin very thin and ſpotted; but the true ſkin was brown, and near an inch in thickneſs. On the top of the head there is only a ſemilunar hole, as in the porpoiſes; this hole opens into the two channels, which run through the ſkull to the palate, and are called the ductus hydrogogi. The people who examined this creature, were not able to find any aperture in the body for the diſcharge of the excrements; whence it has been generally believed, that the creature voids them through this paſſage in the head.

Authors have differed in the name of the proceſs iſſuing from the head, ſome calling it a horn, others a tooth; for ſome are of opinion that it ſerves it to break the ice for air; but others pretend that it is an offenſive weapon, with which it wounds the common whale, and other large fiſh; and that, when it has plunged it up to the head in the whale's body, it ſucks the juices of that animal.

The fiſh was near twenty feet long, and about four feet in diameter. The horn ſtood on the forepart of the head, juſt above the mouth, and was ſix feet long, white like ivory, and curiouſly wreathed or twiſted. The body was ſmooth and ſlippery, like that of an eel; the head, in proportion to the body, was ſmall, not exceeding ſixteen inches in length: the eyes not bigger than a ſixpence. It had, on each ſide of the neck, two black fins, one above, another at a ſmall diſtance; theſe were two feet long, of the breadth of a hand, and about half an inch in thickneſs. *Phil. Tranſ.* N°. 447.

UNICORNU FOSSILE, foſſile unicorn's horn, the name of a ſubſtance much uſed in medicine in ſome parts of the world, and which ſeems to have been very little underſtood by many who have written of it; but is now determined to be no other than a terrene cruſtaceous ſpar, not very different from the oſteocolla, and other bodies of that genus called the cibdeloplacium.

It is eſteemed as a ſudorific and aſtringent, and is given in fevers attended with diarrhœas, with great ſucceſs.

UNIFORM, denotes a thing to be ſimilar, or conſiſtent, either with another thing or with itſelf, in reſpect of figure, ſtructure, proportion, and the like; in which ſenſe it ſtands oppoſed to difform.

Thus the uniform flowers of plants, are ſuch as are of the ſame figure all around, having their fore and back parts, as alſo their right and left parts, exactly alike.

UNIFORM MOTION, &c. See MOTION and EQUABLE.

UNIFORMITY, a ſimilitude, or reſemblance, between the parts of a whole; ſuch is that we meet with in figures of many ſides and angles reſpectively equal, and anſwerable to each other.

UNIOLA, in botany, a genus of plants, whoſe flower conſiſts of a bivalvular glume, or huſk; each valve is of a lanceolato-compreſſed figure, like thoſe of the cup; the inner valve appears ſomewhat higher than the outer one: the ſtamina are three capillary filaments, topped with oblong linear antheræ: there is no pericarpium, but the corolla incloſes the ſeed, which is ſingle, and of an ovato-oblong figure.

UNION, a junction, coalition, or aſſemblage of two or more different things in one.

UNION, among painters, expreſſes a ſymmetry and agreement between the ſeveral parts of a painting; e. g. when there is a great deal of relation and connection between them, both as to the figuring and colouring; ſo that they apparently conſpire to form one thing.

UNION, in an eccleſiaſtical ſenſe, denotes a combining or conſolidating of two churches into one: there are two kinds of this union, as when one church is made ſubject to another, and one parſon is made rector of both; and where a conventual church is made a cathedral.

In caſe two churches were ſo ſmall as that the tythes did not make a competent proviſion for each of the parſons, they might be united at common law before any act of parliament was made for that purpoſe.

By ſtatute, there may be an union of two churches where they lie not above a mile diſtant from each other, and where the value of the one exceeds not ſix pounds a year in the king's books of firſt-fruits; which is done by the conſent of the biſhop, the patron, and incumbent.

Alſo, in cities or corporate towns, it is ordained, that the biſhop, the patron, and the mayors, or chief magiſtrate of the place, &c. may unite pariſh-churches therein: yet, when the income of the church is above one hundred pounds per ann. there the major part of the pariſhioners are to agree to the ſame; and after the union, the patrons of thoſe churches are to preſent by turns, &c. but, notwithſtanding, each of the pariſhes continue diſtinct as to rates, charges, &c.

UNION, or The UNION, by way of eminence, is more particularly uſed to expreſs the act whereby the two ſeparate kingdoms of England and Scotland were incorporated into one, under the title of the kingdom of Great-Britain. This happy union, in vain attempted by king James I. was at length effected in the year 1707, by the general conſent of the queen and the eſtates of each realm. The chief articles of this union are, That the two kingdoms ſhall be united into one kingdom, by the name of Great Britain: that they, in conſequence thereof, be repreſented by one parliament, of which ſixteen peers and forty-five commoners are to be elected for Scotland, and have the ſame privileges with thoſe of England: that the ſubjects of either nation ſhall have equal freedom of trade, and be liable to the ſame cuſtoms, and the like laws for public government, &c.

The kirk, or church of Scotland, is confirmed; and the courts of juſtice are to remain the ſame as they were before the union, yet ſubject to regulation, &c.

A court of exchequer is alſo erected in Scotland, to be a court of record, revenue, and judicature for ever; and barons of the ſaid court are appointed, who ſhall be the judges there, &c.

UNISON, in muſic, the effect of two ſounds which are equal in degree of tune, or in point of gravity and acuteneſs.

Uniſon may be defined a conſonance of two ſounds produced by two ſtrings, or other bodies, of the ſame matter, length, thickneſs, tenſion, &c. equally ſtruck, and at the ſame time: ſo that they yield the ſame tone or ſound.

Uniſon is the firſt and greateſt of concords, and the foundation of all the reſt, according to Ariſtoxenus and moſt of the ancients: yet ſome deny it to be any concord at all, maintaining it to be only that in ſounds which unity is in numbers.

Others reſtrain the word concord to intervals, and make it include a difference of tune; but this is precarious: for as the word concord ſignifies an agreement of ſounds, it is certainly applicable to uniſons of the firſt degree.

But though uniſonance, or an equality of tune, makes the moſt perfect agreement of ſound, it is not true, that the nearer any two ſounds come to an equality of tune, they are the more agreeable. The mind is delighted with variety; and the reaſon of the agreeableneſs or diſ-

agreeableneſs of two ſounds muſt be aſcribed to ſome other cauſe than the quality or inequality of the number of their vibrations. It is a famed phænomenon in muſic, that an intenſe ſound being raiſed, either with the voice or ſonorous body, another ſonorous body near it, whoſe tune is either uniſon or octave to that ſound, will ſound its proper note, uniſon or octave, to the given note. The experiment is eaſily tried by the ſtrings of two inſtruments, or by a voice and harpſichord; or a belt, or even a drinking-glaſs.

This our philoſophers account for thus; one ſtring being ſtruck, and the air put in motion thereby, every other ſtring, within the reach of that motion, will receive ſome impreſſion therefrom: but each ſtring can only move with a determinate velocity of recourſes or vibrations; and all uniſons proceed from equal or equidiurnal vibrations; and other concords, from other proportions. The uniſon ſtring then, keeping equal pace with the ſounding ſtring, as having the ſame meaſure of vibrations, muſt have its motion continued, and ſtill improved, till its motion become ſenſible, and it gives a diſtinct ſound. Other concording ſtrings have their motion propagated in different degrees, according to the frequency of the coincidence of their vibrations with thoſe of the ſounded ſtring; the octave, therefore, moſt ſenſibly: then in the fifth; after which the croſſing of the motions prevents any effect.

This they illuſtrate by the pendulum, which, being ſet a-moving, the motion may be continued, and ſtill improved, and augmented, by making frequent, light, coincident impulſes; as blowing on it when the vibration is juſt finiſhed: but if it be touched by any croſs or oppoſite motion, and this too frequently, the motion will be interrupted and ceaſe altogether. So of two uniſon ſtrings, if the one be forcibly ſtruck, it communicates motion by the air to the other: and being equidiurnal in their vibrations, that is, finiſhing them preciſely together, the motion of the other will be improved and heightened by the frequent impulſes received from the vibrations of the firſt; becauſe given preciſely, when that other has finiſhed its vibration and is ready to return: but if the vibration of the chords be unequal in duration, there will be a croſſing of motions leſs or more, according to the proportion of the inequality; by which the motion of the untouched ſtring will be ſo checked as never to be ſenſible. And this, we find, is the caſe in all conſonances, except uniſon, octave, and the fifth.

UNIT, UNITE, or UNITY, in arithmetic, the number one, or one ſingle individual part of diſcrete quantity.

UNITED NETHERLANDS conſiſt of the provinces of Holland, Zealand, Frieſland, Groningen, Overyſſel, Gelderland, with Zutphen and Utrecht; theſe are bounded by the German ſea on the north and weſt; by the circle of Weſtphalia on the eaſt, and by Flanders, Brabant, and the dutchy of Cleves on the ſouth; lying between 3 deg. 20 min. and 7 deg. 30 min. eaſt long. and between 57 deg. 35 min. and 52 deg. 40 min. north lat. being about fifty miles long, and as many broad, including the Zyder-ſea, which takes up a conſiderable ſpace between theſe limits.

UNITY, in poetry.—The critics require three unities to be obſerved in every regular play, viz. thoſe of action, time, and place.

By the unity of action they mean, that one great action is to be carried on throughout the play, on which all the under actions muſt depend, and which they muſt all have a tendency to promote. For, ſay they, if two actions be equally laboured and driven on by the poet, the unity of the piece will be deſtroyed, and it will no longer be one play, but two. The action muſt alſo have a beginning, middle, and end; which F. Boſſu, a celebrated French critic, thus explains: The cauſes and deſigns of undertaking an action, are the beginning; the effects of thoſe cauſes, and the difficulties met with in the execution of it, are the middle; and the unravelling and removing theſe difficulties, is the end.

By unity of time, ſtrictly ſpeaking, is meant, that all the tranſactions repreſented in a play, may naturally be ſuppoſed to have paſſed in as little time as is taken up in the repreſentation. This rule indeed is very ſeldom obſerved by dramatic poets; and the critics are not agreed about the matter, ſome allowing twenty-four hours, others twelve, and others but four or five, for the time of the action. But, as every play ought to be a juſt imitation of nature, the greater the likeneſs in this particular, as well as others, the more perfect the piece muſt be eſteemed.

What is meant by unity of place, is, that the ſcene ſhould never be ſhifted throughout the play, but remain in the ſame place where it was laid at the beginning. This indeed would be to keep cloſe to nature and probability; for what is preſented on the ſame ſtage, which is never moved, ſhould be ſuppoſed to have paſſed in the ſame houſe, and the ſame apartment. But, as this reſtraint would cramp the poet too much, and would ſuit very ill with abundance of ſubjects, the unity of place is allowed to be ſufficiently obſerved, if the action is confined to the ſame town or city: the ſcene, however, ought never to be changed in the middle of an act. In general, the French, in imitation of the ancients, obſerve this law more ſtrictly than the Engliſh; but the more judicious and accurate of our writers take care not to deviate too far from probability, by ſhifting the ſcene between the acts much farther than the perſons concerned may be ſuppoſed to have gone in the interval, and therefore ſeldom carry it out of the ſame town. Others have no regard at all to unity of place; and moſt of our great Shakeſpear's plays are faulty in this reſpect.

UNITY, *Unitas*, the abſtract, or quality, which conſtitutes, or denominates a thing *unum*, or one.

The ſchool philoſophers generally define unity, by a thing's being undivided in itſelf, and divided from every thing elſe. Others, more accurately, define it a mode of being, whereby it agrees to any particular being, once: theſe make two kinds of unity, viz. unity of ſimplicity, which is both undivided and indiviſible; ſuch as that of God, angels, and human ſouls: the other union of compoſition, which, though undivided, is diviſible in the being, as conſiſting of divers parts: ſuch is that of man, &c.

Hence, unity is alſo divided into that per ſe, which agrees to any being whoſe parts are collected into one ſubſtratum; and unity per accidens, whoſe parts are not united into one ſubſtratum; as that of a flock of ſheep, &c.

Some alſo make a ſingular, or numerical unity, and an univerſal unity; a real, and an imaginary, unity, &c.

It is diſputed among mathematicians, whether or no unity be a number? The generality of authors hold the negative, and make unity to be only inceptive of number, or the principle thereof; as a point is of magnitude, and an uniſon of concord.

Stevinus is very angry with the maintainers of this opinion: and yet, if number be defined a multitude of units joined together, as many authors define it, it is evident that unity is not itſelf a number.

UNITY, among divines.—The Romaniſts and the reformed diſpute, whether or no the church be one ſingle body, all the members of which are joined together, either really, or in inclination; ſo that whatever does not appertain to that body, is no part of the church: which is what they call the unity of the church; and which the Romaniſts maintain to be reſtrained to one ſingle ſociety, or one communion, under one viſible head; and out of which the proteſtants are excluded! Theſe laſt, on the contrary, hold, that the unity of the church may ſtill ſubſiſt without the members being united under any one viſible head; it being ſufficient, that all Chriſtians be united by the bonds of mutual love and charity; and that they be agreed in the fundamental points of religion.

All the difficulty is, to fix what thoſe fundamentals are; ſome inclining to make the door of the church wider than others.

UNIVALVE *Shells*, in natural hiſtory, a term uſed to expreſs one of the three general claſſes of ſhell fiſh; the other two are the bivalves and multivalves. The univalve ſhells are thoſe which conſiſt only of one piece, not of two or more joined together.

UNIVERSAL, ſomething that is common to many things; or it is one thing belonging to many, or all things.

In logic, univerſal is either complex or incomplex. A complex univerſal is either an univerſal propoſition, as every whole is greater than its part; or whatever raiſes a manifold conception in the mind, as the definition of a reaſonable animal. An incomplex univerſal, is what produces only one conception in the mind, and is a ſimple thing reſpecting many; as human nature, which relates to every individual wherein it is found.

UNIVERSALITY, that quality which denominates a thing univerſal. See the preceding article.

UNIVERSE, a collective name, ſignifying the whole world, or the aſſemblage of heaven and earth with all things therein.

As ſpace is, in its own nature, every way infinite; it gives us an idea of the infinity of the univerſe, which can therefore be only in part comprehended by us: and that part of the univerſe which we can have any notion of, is that which is the ſubject of our ſenſes; and of this the eye preſents us with an idea of a vaſt extended proſpect, and the appearance of various ſorts of bodies diſſeminated through the ſame.

The infinite abyſs of ſpace, which the Greeks call το κενον, the Latins *inane*, and we the univerſe, does undoubtedly comprehend an infinity of ſyſtems of moving bodies round one very large central one, which the Romans call *ſol*, and we the ſun. This collection of bodies is therefore properly called the ſolar ſyſtem, and ſometimes the mundane ſyſtem, from the Latin word *mundus*, the world. See the article SYSTEM.

That the univerſe contains as many ſolar ſyſtems, or worlds, as there are what we call fixed ſtars, ſeems reaſonable to infer from hence, that our ſun, removed to the diſtance of a ſtar, would appear juſt as a ſtar does, and all the bodies moving about it would diſappear entirely. Now, the reaſon why they diſappear, is becauſe they are opake bodies, and too ſmall to be ſeen at ſo great a diſtance, without an intenſe degree of light; whereas theirs is the weakeſt that can be, as being firſt borrowed, and then reflected to the eye. See the article STAR.

But the ſun, by reaſon of his immenſe bulk and innate light, which is the ſtrongeſt poſſible, will be viſible at an immenſe diſtance; but the greater the diſtance, the leſs bright it will appear, and of a leſſer magnitude: and therefore every ſtar of every magnitude, may probably be a ſun like our own, informing a ſyſtem of planets, or moving bodies, each of which may be inhabited like our earth, with various kinds of animals, and ſtored with vegetable and other ſubſtances.

We can perceive, ſays Mr. Mac Laurin, no bounds of the vaſt expanſe in which natural cauſes operate; nor can we fix any border or termination of the univerſe; and we are equally at a loſs to trace things to their elements, and to diſcover the limits which incloſe the ſubdiviſions of matter.

The objects, which we commonly call great, vaniſh when we contemplate the vaſt body of the earth: the terraqueous globe itſelf is ſoon loſt in the ſolar ſyſtem; being in ſome parts ſeen as a planet, or diſtant ſtar; and in great part of the ſyſtem unknown, or viſible only at rare times to vigilant obſervers, aſſiſted perhaps with inſtruments like our teleſcopes. The ſun itſelf dwindles into a ſtar: Saturn's vaſt orbit, and the orbits of all the comets, croud into a point, when viewed from numberleſs places between the earth and the neareſt fixed ſtars. Other ſuns illuminate other ſyſtems, where our ſun's rays are unperceived; but all theſe alſo are ſwallowed up in the vaſt expanſe of the univerſe. Even all the ſyſtems of the ſtars that ſparkle in the cleareſt ſky, muſt poſſeſs a ſmall corner only of that ſpace over which ſuch ſyſtems are diſperſed. And after we have riſen ſo high, and left all definite meaſures ſo far behind us, we find ourſelves no nearer to a term or limit; for all this is nothing to what may be diſplayed in the infinite expanſe, beyond the remoteſt ſtars that ever have been diſcovered.

In this view of the univerſe, an auguſt idea ariſes in the mind, worthy of the infinite and wiſe Author of nature, who can never be ſuppoſed to have created ſo many glorious orbs, to anſwer ſo trifling a purpoſe as the twinkling to mortals by night now and then; beſides that, the far greateſt part of the ſtars are never ſeen by us at all, as has been ſhewn under the article STAR, which ſee.

UNIVERSITY, *Univerſitas*, a collective term, applied to an aſſemblage of ſeveral colleges, eſtabliſhed in a city, or out-town, wherein are profeſſors in the ſeveral ſciences, appointed to teach them to ſtudents; and where degrees or certificates of ſtudy in the divers faculties are taken up.

In each univerſity four faculties are uſually taught; theology, medicine, law, and the arts and ſciences.

They are called univerſities, or univerſal ſchools, by reaſon the four faculties are ſuppoſed to take in the whole compaſs of ſtudy.

In the eye of the law, an univerſity is held a mere lay body, or community; though, in reality, it be a mixed body, compoſed partly of laymen, and partly of eccleſiaſtics.

Univerſities had their firſt riſe in the XIIth and XIIIth centuries. Thoſe of Paris and Bologna pretend to be the firſt that were ſet on foot; but then they were on a different footing from the univerſities among us.

Our own univerſities, of Oxford and Cambridge, ſeem entitled to the greateſt antiquity of any in the world; and Baliol and Merton colleges, in Oxford, and St. Peter's in Cambridge, all made colleges the XIIIth century, may be ſaid to be the firſt regular endowments of this kind in Europe. For though Univerſity college in Cambridge had been a place for ſtudents ever ſince the year 872, yet this, like many of the ancient colleges beyond ſea, and Leyden to this day, was no proper college; but the ſtudents, without any diſtinction of habit, lived in citizens houſes, having only meeting-places to hear lectures and diſputes.

In after times, there were houſes built for the ſtudents to live in ſociety; only each to be at his own charge, as in the inns of court: theſe, at firſt, were called inns, but now halls. At laſt, plentiful revenues were ſettled on ſeveral of theſe halls, to maintain the ſtudents in diet, apparel, &c. and theſe were called colleges. See COLLEGE.

The univerſities of Oxford and Cambridge are governed next under the king, by a chancellor, who is to take care of the government of the whole univerſity, to maintain the liberties thereof, &c. Under him is the high-ſteward, whoſe office is to aſſiſt the chancellor and other officers, when required, in the execution of their offices, and to hear and determine capital cauſes, according to the laws of the land, and the privileges of the univerſity. The next officer is the vice-chancellor, who officiates for the chancellor in his abſence.

There are alſo two proctors, who aſſiſt in the government of the univerſity, particularly in the buſineſs of ſchool exerciſe, taking up degrees, puniſhing violators of the ſtatutes, &c. Add to theſe, a public orator, keeper of records, regiſter, beadles, and verger.

The univerſities of Scotland are four, viz. thoſe of St. Andrew, Aberdeen, Edinburgh, and Glaſgow. In Ireland there is only one univerſity, viz. that of Dublin.

UNIVOCAL, in the ſchools, is applied to two or more names, or terms, that have but one ſignification, in oppoſition to equivocal, which is where one term has two or more ſignifications.

Our univocal terms are ſuch, whoſe name, as well as nature, is the ſame, in oppoſition to equivocals, whoſe names are the ſame, but their natures very different.

The ancients believed that all perfect animals were produced by univocal generation; that is, by the ſole union or copulation of a male and female of the ſame ſpecies or denomination; and that inſects were produced by equivocal generation, without any ſeed, and merely of the corruption of the earth, exhaled, and, as it were, impregnated, by the ſun's rays: but this doctrine of inſects is now exploded.

UNLAWFUL, illegal, ſomething prohibited by, or contrary to, the terms of law, either divine or human.

UNLAWFUL ASSEMBLY, the meeting of three or more perſons together, by force to commit ſome unlawful act, as to aſſault any perſon, to enter his houſe or land, &c. and thus abiding together, whether they attempt the execution or not.

UNLIMITED, or INDETERMINATE PROBLEM, is ſuch a one as is capable of infinite ſolution. See PROBLEM.

UNMOOR, a term uſed at ſea: when a veſſel which was riding at anchor weighs the ſame, or gets it up, in order to ſail, they ſay ſhe is unmooring.

VOCABULARY, *Vocabularium*, in grammar, denotes the collection of the words of a language, with their ſignifications, otherwiſe called a dictionary, lexicon, or nomenclature. See the article DICTIONARY, &c.

A vocabulary is properly a leſſer kind of dictionary, which does not enter ſo minutely into the origins and different acceptations of words.

VOCAL, ſomething that relates to the voice or ſpeech: thus vocal muſic is that ſet to words, eſpecially verſes, and to be performed by the voice, in contradiſtinction to inſtrumental muſic, compoſed only for inſtruments, without ſinging. See the article VOICE, VERSE, &c.

VOCATIVE, in grammar, the fifth ſtate or caſe of nouns.

When we name the perſon we are ſpeaking to, or addreſs ourſelves to the thing we are ſpeaking of, as if it were a perſon, the noun, or name, requires a new relation, which the Latins and Greeks expreſs by a new termination, called the vocative; as from *Dominus*, a Lord, is formed the vocative *Domine*, O Lord.

In Engliſh, and moſt of the modern languages, the vocative is expreſſed in nouns that have an article in the nominative, by omitting that article; as *The Lord is my hope*; *Lord, thou art my hope*; though, on many occaſions, we uſe an interjection.

VOICE, *Vox*, a ſound produced in the throat and mouth of an animal, by an apparatus of inſtruments for that purpoſe. See SOUND.

Voices are either articulate or inarticulate. Articulate voices are thoſe of which ſeveral conſpire together to form ſome aſſemblage or little ſyſtem of ſounds; ſuch are the voices expreſſing the letters of an alphabet, numbers of which joined together, form words. Inarticulate voices are ſuch as are not organized, or aſſembled into words; ſuch is the barking of dogs, the braying of aſſes, the hiſſing of ſerpents, the ſinging of birds, &c.

The formation of the human voice, with all the varieties thereof obſerved in ſpeech, muſic, &c. makes a very curious article of inquiry; and the apparatus and organiſm of the parts adminiſtering thereto, is ſomething exceedingly ſurprizing. Thoſe parts are the trachea or wind-pipe, thro' which the air paſſes and repaſſes into the lungs; the larynx, which is a ſhort cylindric canal at the head of the trachea; and the glottis, which is a little oval cleft or chink left between two ſemicircular membranes ſtretched horizontally withinſide the larynx; which membranes, though capable of joining cloſe together, do generally leave an interval, either greater or leſs, between them, called the glottis.

The long canal of the trachea, terminated at top with the glottis, appears ſo like a flute, that the ancients made no doubt but the trachea contributed the ſame to the voice, as the body of the flute does to the ſound of that inſtrument. Galen himſelf fell in ſome meaſure into the miſtake; he perceived indeed, that the principal organ of the voice was the glottis, but he ſtill allowed the trachea a conſiderable ſhare in the production of the ſound.

Galen's opinion was followed by all the ancients after him, and even by all the moderns before M. Dodart: but that author obſerves, that we do not either ſpeak or ſing when we inſpire or take in the air, but only when we exſpire or expel it; and that the air coming out of the lungs, paſſes always out of the minuter veſicles of that part into larger, and at laſt into the trachea itſelf, which

is the largeſt of all: that thus its paſſage becoming ſtill more free and eaſy, and thus more than ever in the trachea, it can never undergo ſuch a violence, and acquire ſuch a velocity in that canal, as is required to the production of ſound: but that as the aperture of the glottis is very ſmall, in compariſon with the width of the trachea, the air can never get out of the trachea by the glottis, without a vaſt compreſſion and augmentation of its velocity; and that by this means in paſſing, it communicates a briſk agitation to the minuter parts of the two lips of the glottis, and gives them a kind of ſpring, and occaſions them to make vibrations, which communicated to the paſſing air, are what really occaſion the ſound. The ſound thus formed, proceeds into the cavity of the mouth and noſtrils, where it is reflected and reſounds: and on this reſonance, M. Dodart ſhews, it is that the agreeableneſs of the voice intirely depends. The different conſiſtences, forms, &c. of the divers parts of the mouth, contribute to the reſonance, each in their way; and from this mixture of ſo many different reſonances in their due proportion, there reſults an harmony in the human voice inimitable by any muſician.

Hence it is that when any of theſe parts are diſordered, e. g. when the noſe is ſtopped, the voice becomes diſpleaſing. This reſonance in the cavity of the mouth, does not ſeem to conſiſt in a ſimple reflexion, ſuch as that of a vault, &c. but in a reſonance proportionate to the tones of the ſound ſent into the mouth from the glottis; and accordingly we find this cavity to lengthen and ſhorten itſelf according to the depth or acuteneſs of the tone.

As the organs that form the voice make a kind of wind inſtrument, one might imagine to find ſome proviſion therein anſwerable to that which produces the difference of tone in ſome other wind-inſtruments. The tone, therefore, muſt be attributed, either to the mouth and noſtrils, which occaſion the reſonance, or to the glottis, which produces the ſound: and as all the different tones are produced in man by the ſame inſtrument, it follows, that the part which produces them, muſt be capable of changes anſwerable thereto. The different apertures of the lips of the glottis, it is proved, produce all the different tones in the ſeveral parts of muſic, and the manner is thus. The voice, it is ſhewn, can only be formed by the glottis, but the tones of the voice are modifications of the voice, and theſe can only be produced by the modifications of the glottis. Now the glottis is capable only of one modification, which is the mutual approach or receſs of its lips; it is this, therefore, produces the different tones. Now that modification includes two circumſtances; the firſt and principal is, that the lips are ſtretched more and more from the loweſt tone to the higheſt: the ſecond is, that the more they are ſtretched, the nearer they approach. From the firſt, it follows, that their vibrations will be ſo much the quicker, as they come neareſt their higheſt tone: and that the voice will be juſt, when the two lips are equally ſtretched; and falſe, when unequally; which agrees perfectly well with the nature of ſtring inſtruments. From the ſecond, it follows, that the higher the tones are, the nearer will they approach to each other, which agrees perfectly well with inſtruments governed by reeds or plugs.

The degrees of tenſion of the lips, are the firſt and principal cauſe of tones, but their differences are inſenſible; the degrees of approach are only conſequences of that tenſion, but their differences are more eaſily aſſigned. They are different apertures that produce, or at leaſt that accompany, different tones, both in natural wind inſtruments, and artificial ones; and the diminution of the aperture raiſes the tones both of the glottis, and the reed.

VOICE, in grammar, a circumſtance in verbs, whereby they come to be conſidered as either active or paſſive, i. e. either expreſſing an action impreſſed on another ſubject, as, *I beat*, or receiving it from another, as, *I am beaten*.

The Greeks have a third voice called the medial voice, thus denominated, becauſe it has ſometimes an active

active and ſometimes a paſſive ſignification: though generally it is of an active ſignification. With regard to the termination of this medial voice, it is to be obſerved, that the preſent and imperfect tenſes are the ſame with thoſe of the paſſive voice; or, in other words, when theſe tenſes of the paſſive voice are taken actively, they are then denominated of the medial voice.

VOICE, in matters of election, denotes a vote or ſuffrage.

In this ſenſe a man is ſaid to have a deliberate voice, when he has a right to give his advice and opinion in a matter of debate, and his ſuffrage is taken. An active voice, when he gives his vote for the election of any one; and a paſſive voice, when the ſuffrages may fall on himſelf to be elected. An excitative voice, when he may act to procure another to be elected. A conſultative voice, when he can only offer reaſons and remonſtrances, whereon the chief or head determines at his own diſcretion.

VOID SPACE, in phyſics. See the article VACUUM.

VOID and VOIDABLE, terms frequently uſed in our law; as a thing that is done contrary to law at the time of the doing, it is ſaid to be void, and no perſon ſhall be bound thereby. But where a thing is only voidable, and not void, though it be what the perſon that did it ought not to have done, yet when it is done, the doer cannot avoid the ſame, notwithſtanding by ſome act in law it may be void in his heir, &c. It has been held, that the bond of an infant, or one non compos mentis, is void, becauſe the law has not appointed the doing any thing to avoid ſuch bonds. A leaſe for term of life, which is voidable, muſt be made void by re-entry, &c. and a deed is generally avoided by ſpecial pleading.

VOIDANCE, or VACANCY, in the canon law, a want of an incumbent upon a benefice, &c.

VOIDED, in heraldry, is underſtood of an ordinary whoſe inner or middle part is cut out, leaving nothing but its edges to ſhew its form, ſo that the field appears through it. Hence it is needleſs to expreſs the colour or metal of the voided part, becauſe it muſt of courſe be that of the field. The croſs voided, differs from the croſs fimbriated, in that the latter does not ſhew the field through it, as the other does; and the ſame obtains in other ordinaries.

VOIDER, in heraldry, one of the ordinaries whoſe figure is much like that of a flaſk of flanch, only that it does not bend ſo much.

VOIDING, or EVACUATING, in medicine. See EVACUATION.

VOL, among heralds, ſignifies the two wings of a fowl joined together, borne in armoury, as being the whole that makes the flight. Accordingly, a demi-vol is a ſingle wing.

VOLA, the palm, or inſide of the hand, comprehended between the fingers and the wriſt.

VOLANT, in heraldry, is when a bird in a coat of arms is drawn flying, or having its wings ſpread open.

VOLATILE, in phyſics, is commonly uſed to denote a mixed body whoſe integral parts are eaſily diſſipated by fire or heat; but it is more properly uſed for bodies whoſe elements or firſt component parts are eaſily ſeparated from each other, and diſperſed in air. For as any mixed body is ſaid to be fixed in a double ſenſe, ſo may it be ſaid to be volatile two ways; whence the ſame body, e. gr. mercury, is both volatile and fixed at the ſame time; ſince, as its integral parts, or thoſe which ſtill retain the nature of mercury, are eaſily ſeparable by fire, and readily flies away, it is ſaid to be volatile; and yet as it is very difficult to deſtroy its contexture, and reſolve it by fire, or any other menſtruum, into its firſt elements, it is ſaid to be fixed; the ſame may be ſaid of ſulphur, antimony, &c.

Minerals, for the generality, are leſs volatile than vegetables, and vegetables are leſs ſo than animals. The chemiſts diſtinguiſh greatly between volatile ſalts and fixed ſalts. The capitals of aludels ſtop and collect the volatile parts of ſubſtances, in ſublimation, and make what we call flowers.

The particles of fluids which do not cohere very ſtrongly together, ſays Sir Iſaac Newton, and are of ſuch a ſmallneſs as renders them moſt ſuſceptible of thoſe agitations which keep liquors in a fluor, are moſt eaſily ſeparated and rarified into vapour; and, in the language of the chemiſts, they are volatile, rarifying with an eaſy heat, and condenſing with cold. But thoſe which are groſſer, and by that means leſs ſuſceptible of agitation, or cohere by a ſtronger attraction, are not ſeparated without a ſtronger heat, or perhaps not without fermentation; theſe are what the chemiſts call fixed bodies.

When the fire decompounds any mixed body, the parts moſt diſpoſed to receive a great motion are ſooneſt looſened, and riſe up in the order which the differences of that diſpoſition give them, the reſt remaining immoveable at the bottom of the veſſel. Thoſe that riſe firſt are called volatile parts; ſuch are phlegm, oil, ſpirits and ſalts, both urinous and alcalous. The parts remaining, viz. earth and lixivial ſalts, are called fixed.

VOLATILISATION, or VOLATILIZATION, the act of rendering fixed bodies volatile, or of reſolving them by fire into a fine ſubtile vapour or ſpirit, which eaſily diſſipates and flies away. All bodies, even the moſt fixed, as gold, may be volatilized; either of themſelves, or with the admixture of ſome volatile ſubſtance, or ſpirit, by diſtillation or ſublimation.

VOLCANO, or VULCANO. See the article VULCANO.

VOLLEY, a military ſalute, made by diſcharging a great number of fire-arms at the ſame time.

VOLT, or VOLTE, in the manege, a round or circular tread; and hence, by the phraſe, to make volts, is underſtood a gait of two treads, made by a horſe going ſideways round a center, in ſuch a manner, that theſe two treads make parallel tracts, one larger, made by the fore-feet, and another ſmaller, made by the hind-feet, the croup approaching towards the center, and the ſhoulders bearing outwards.

Sometimes the volt is of one tread; as when a horſe makes volts in corvets, and in caprioles, ſo that the haunches follow the ſhoulders, and move forwards on the ſame tread.

In general, the way and tract of a volt is made ſometimes round, ſometimes oval, and ſometimes ſquare, of four ſtraight lines; ſo that theſe treads, whether round or ſquare, incloſe a terrain, or manege ground, the middle of which is ſometimes diſtinguiſhed by a pillar, or elſe by an imaginary center, which is there ſuppoſed in order to regulate the diſtances and the juſtneſs of the volt.

A demi-volt is a demi-round of one or two treads, made by the horſe at one of the corners of the volt, or elſe at the end of the line of the paſſade; ſo that being near the end of this line, or one of the corners of the volt, he changes hands, to return by a ſemi-circle.

A renverſed volt is a tract of two treads, made by the horſe, with his head to the center, and his croup out; ſo that he goes ſideways upon a walk, trot, or gallop, and traces out a ſmall circumference with his ſhoulders, and a larger one with his croup.

This different ſituation of the ſhoulders and the croup, with reſpect to the center, gave this volt the name of renverſed, as being oppoſite in ſituation to the former.

VOLUBILIS, in botany, a name uſed by Dillenius for a ſpecies of convolvulus. See the article CONVOLVULUS.

VOLUME, *Volumen*, in matters of literature, a book, or writing, of a juſt bulk to be bound by itſelf. The name is derived from the Latin *volvere*, to roll up; the ancient manner of making up books being in rolls of bark or parchment.

Foreign philoſophers uſe the phraſe, volume of a body, for its bulk, or the ſpace contained within its ſuperficies.

VOLUNT, *Voluntas*, in law, is when a tenant holds land, &c. at the will of the leſſor, or lord of the manor,

VOLUNTARY, in muſic, a piece played by a muſician, extempore, according to his fancy. This is often uſed before he begins to ſet himſelf to play any particular compoſition, to try the inſtrument, and to lead him into the key of the piece he intends to perform.

VOLUNTEERS, in the military art, perſons who, of their own accord, and at their own expence, ſerve in the army.

VOLUTA, in natural hiſtory, a genus of univalve ſhells, with an oblong mouth, a clavicle ſometimes erect and ſometimes depreſſed, and ſometimes coronated at top.

To this genus belong the admiral-ſhells, tiger-ſhells, &c.

VOLUTE, *Voluta*, in architecture, a kind of ſpiral ſcroll, uſed in the Ionic and Compoſite capital: whereof it makes the principal characteriſtic and ornament.

There are ſeveral diverſities practiſed in the volute. In ſome, the liſt or edge, throughout all the circumvolutions, is in the ſame line or plane; ſuch are the antique Ionic volutes, and thoſe of Vignola. In others, the ſpires or circumvolutions fall back; in others, project and ſtand out. Again, in others, the circumvolutions are oval; in others, the canal of one circumvolution is detached from the liſt of another by a vacuity or aperture. In others, the rind is parallel to the abacus, and ſprings out from behind the flower thereof. In others, it ſeems to ſpring out of the vaſe from behind the ovum, and riſes to the abacus, as in moſt of the fine Compoſite capitals.

VOLVULUS, in medicine, a name which ſome authors give to the iliac paſſion, by others called chordapſus, and by others miſerere mei.

VOMER, in anatomy, a bone of the upper jaw, ſituated between the bones of the palate and the ſphenoidal bone, being alſo joined to the proceſs of the ethmoides, and part of the lower jaw, and having its fore part, which is ſpongy, continued to the middle cartilage of the noſe, and making, in conjunction with it, the ſeptum naſi.

VOMICA, in medicine, is commonly taken for a ſuppurated impoſthume, or an abſceſs with a ſuppuration.

The vomica pulmonum is a latent diſeaſe of the lungs, which often deceives under a ſhew of health. What goes by this name, is a ſmall abſceſs ſeated in ſome part of the lungs, and ſtraitly incloſed within a bag or membrane. This diſorder is moſt incident to thoſe who are afflicted with a tabes, or labour under an anaſtomoſis or rupture of a vein in the lungs. In this diſeaſe, the breath ſmells ill long before the vomica breaks; ſometimes blood comes up with coughing, the body is perfectly dull and heavy, and the cough very long and troubleſome, and ſometimes followed by an expectoration of the vomica, in which caſe the patient is ſeized with no ſmall fever, ſucceeded by bloody ſpit, and a vaſt perturbation of body; the conſequence of which circumſtance may poſſibly be a recovery to a good ſtate of health. It has often happened that the vomica, by a ſudden rupture, has occaſioned ſudden and unexpected death.

VOMIT, or EMETIC, in pharmacy. See the article EMETIC.

VOMITING, in medicine, a retrograde ſpaſmodic motion of the muſcular fibres of the oeſophagus, ſtomach, and inteſtines, attended with ſtrong convulſions of the muſcles of the abdomen and diaphragm, which, when gentle, create a nauſea; when violent, a vomiting. Theſe convulſive diſorders proceed from the immoderate quantity, or acrimony of the food; from poiſons; from ſome injury of the brain, as a wound, contuſion, compreſſion, or inflammation of that part, from an inflammation of the diaphragm, ſtomach, inteſtines, ſpleen, liver, kidneys, pancreas, or meſentery; from an irritation of the gula; from a diſorderly motion of the ſpirits, by unaccuſtomed agitations in a coach, ſhip, or otherwiſe, or from the idea of ſome thing nauſeous.

The two principal curative indications to be obſerved are, firſt, to quiet and compoſe the convulſive and unruly motion of the ſtomach: and, ſecondly, to oppoſe and ſubdue the material cauſes of the diſorder.

The firſt intention is anſwered by corroborating and antiſpaſmodic medicines, ſuch as ſaffron and caſtor, with the teſtaceous powders, as coral, crabs-claws, and oyſter-ſhells; powders, compoſed of cinnamon, the leaves of mint, nutmeg, orange peel, calamus aromaticus, and other ſuch ſimples, are alſo of great ſervice. And if anodynes are found neceſſary, the ſtorax pill, or Sydenham's laudanum, are to be given.

While theſe medicines are taken internally, there may alſo be applied outwardly, to the region of the ſtomach, ſuch things as have power to repreſs its diſorderly motions; of this kind are the oil of mint, nutmeg, and the like, with balſam of Peru: theſe oils may be reduced to a proper conſiſtence, with this balſam, for the ſpreading on leather, and laying on for ſome time. Hungary water, and other the like ſpirits, are of great uſe alſo, rubbed on with the hand; and to theſe may be added yeaſt, and the ſtrongeſt wine-vinegar applied hot to the part. Finally, an excellent application is balſam of Peru alone, reduced to the conſiſtence of a cataplaſm, with crumb of bread. The methods to be uſed to remove the material cauſes of the vomiting, are next to be conſidered: if it be of the pituitous kind, and owing to crudities in the primæ viæ, and a viſcid mucus ſticking to them, it is beſt cured by an emetic: if the vomiting of itſelf be found not ſufficient to carry off the ſordes which occaſion it, and the patient continues, after the fits of vomiting, afflicted with a nauſea and heart-burn; in this caſe, a large quantity of warm water, with a little butter, may ſerve the purpoſe; or if this be found inſufficient, a doſe of ipecacuanha is to be given.

VOMITING *of blood*, *vomitus cruentus*, a very dangerous kind of hæmorrhage, conſiſting in a bringing up by vomit of pure and unmixed blood from the ſtomach, and being a method uſed by nature to throw off a portion of the blood, which moleſts the whole in the vena porta, and by that means to facilitate the circulation of the reſt of the maſs.

This diſtemper ſometimes ariſes from internal cauſes, and is regularly periodical, obſerving the ſtated times of the eruptions of the menſes, or other natural diſcharges; ſometimes it ariſes from accidents, ſuch as the giving of violent purging or emetic medicines, or corroſive ones. Among the preceding ſigns of this diſorder, are to be reckoned a ſenſation of ſtraitneſs and anxiety in the præcordia, with tenſion, and involuntary ſighs; with a nauſea or ſickneſs of the ſtomach, and a ſtraining to vomit; which is more violent than in vomiting on any other occaſion; after this the blood is thrown up pure, and the vomiting then ceaſes, till, after a plain ſenſation of more blood being collected in the ſtomach, the efforts to diſcharge it in the ſame manner are again renewed. The quicker the blood is thrown up, after its being diſcharged into the ſtomach, the more fluid and more florid it appears; the longer it is detained there, the blacker and thicker it appears.

A vomiting of blood is but an uncommon diſorder. It more frequently attacks women than men; among the female ſex it is principally ſeen in thoſe whom the menſes have left too early in life, or who have had violent ſuppreſſions of them for a long time. In men, this diſtemper ſeldom ſeizes any but thoſe who have been uſed to periodical diſcharges from the hæmorrhoidal veſſels, and who have had them ſuddenly ſtopped; and they are then uſually firſt attacked with violent pains in the left hypochondrium. People of ſcorbutic habits, and ſuch as have had quartan agues of long ſtanding, have been ſometimes thus affected. And, beſide theſe natural cauſes, people of all ages and ſexes may vomit blood, from external injuries.

A vomiting of blood is ever a dangerous diſorder; for though the quantity of blood thrown up is ſeldom ſo great as to occaſion immediate death, yet it generally degenerates into a tabes in men, and into a cachectic habit in women. It is leſs dangerous to young women, than to any other perſons; and when it is periodical, eſpecially when it obſerves the time of the menſtrual diſcharges, is much leſs dangerous than under any other circum-

ſtances. During the paroxyſm, the proper medicines are powder of nitre, cinnabar, and the abſorbent ſubſtances, ſuch as crab's-eyes, or the like, and afterwards bleeding, cupping, and gentle purges; and diaphoretics are to be given for ſome time.

VORTEX, in meteorology, a whirlwind, or ſudden, rapid, or violent motion of the air in gyres or circles.

Vortex is alſo uſed for an eddy or whirlpool; or a body of water, in certain ſeas or rivers, which runs rapidly around, forming a ſort of cavity in the middle.

An artificial VORTEX, expreſſive of the phænomena of the natural ones, may be made with a cylindric veſſel, placed, immoveable, on a horizontal plane, and filled to a certain height with water. In this water a ſtick being plunged, and turned round as briſkly as may be, the water is neceſſarily put into a pretty rapid circular motion; and riſes to the very edge of the veſſel; and when there arrived, ceaſes to be further agitated.

The water thus raiſed, forms a cavity in the middle, whoſe figure is that of a truncated cone; its baſe is the ſame with the upper cavity of the veſſel; and its vertex is the axis of the cylinder.

What raiſes the water at the ſide of the veſſel, which occaſions the cavity in the middle, is its centrifugal force. For the motion of the water being circular, it reſpects a centre taken in the axis of the veſſel; or, which is the ſame, in the axis of the vortex formed by the water, the ſame velocity then being impreſſed on all the water, the circumference of a ſmaller circle of water, or a circle leſs remote from the axis, has a greater centrifugal force than another that is greater, or more remote from the axis. The ſmaller circle, therefore, drives the greater towards the ſide of the veſſel; and from this preſſion, or impulſion, which all the circles receive from the ſmaller ones that precede them, and convey to the greater which follow them, ariſes that elevation of the water along the edge of the veſſel to the very top, where we ſuppoſe the motion to ceaſe.

With a vortex thus formed, M. Saulmon, of the Royal Academy of Sciences, made divers experiments, by putting ſeveral ſolid bodies therein, to acquire the ſame circular motion; with intent to diſcover which of them, in making their revolutions round the axis of the vortex, approach toward, or recede from it, and with what velocity. The reſult was, that the heavier the body, ſtill the greater was its receſs from the axis.

M. Saulmon's view in this attempt, was, to ſhew how the laws of mechanics produce the celeſtial motions; and that it is probably to thoſe motions that the gravity or weight of bodies is owing. But, unhappily, the experiments ſhew juſt the contrary of what they ſhould do, to confirm the Carteſian doctrine of gravity.

VORTEX, in the Carteſian philoſophy, is a ſyſtem or collection of particles of matter moving the ſame way, and round the ſame axis.

Such vortices are the grand machines, whereby thoſe philoſophers ſolve moſt of the motions and other phænomena of the heavenly bodies. Accordingly, the doctrine of theſe vortices makes a great part of the Carteſian philoſophy.

The matter of the world, they hold to have been divided at the beginning into innumerable little equal particles, each endowed with an equal degree of motion, both about its own centre and ſeparately, ſo as to conſtitute a fluid.

Several ſyſtems, or collections of this matter, they further hold to have been endowed with a common motion about certain points, as common centres, placed at equal diſtances; and that the matters moving round theſe, compoſed ſo many vortices.

Then the primitive particles of the matter they ſuppoſe, by theſe inteſtine motions, to become, as it were, ground into ſpherical figures, and ſo to compoſe globules of divers magnitudes; which they call the matter of the ſecond element; and the particles rubbed, or ground off them, to bring them to that form, they call the matter of the firſt element.

And ſince there would be more of this firſt element than would ſuffice to fill all the vacuities between the globules of the ſecond, they ſuppoſe the remaining part to be driven towards the center of the vortex, by the circular motion of the globules; and that being there amaſſed into a ſphere, it would produce a body like the ſun.

This ſun being thus formed, and moving about its own axis with the common matter of the vortex, would neceſſarily throw out ſome parts of its matter, through the vacuities of the globules of the ſecond element conſtituting the vortex; and this eſpecially at ſuch places as are fartheſt from its poles; receiving at the ſame time by theſe poles, as much as it loſes in its equatorial parts. And, by this means, it would be able to carry round with it thoſe globules that are neareſt, with the greater velocity; and the remoter, with leſs. — And by this means, thoſe globules which are neareſt the center of the ſun, muſt be ſmalleſt; becauſe, were they greater, or equal, they would, by reaſon of their velocity, have a greater centrifugal force, and recede from the center. If it ſhould happen that any of theſe ſun-like bodies, in the centers of the ſeveral vortices, ſhould be ſo incruſtated, and weakened, as to be carried about in the vortex of the true ſun: if it were of leſs ſolidity, or had leſs motion than the globules towards the extremity of the ſolar vortex, it would deſcend towards the ſun, till it met with globules of the ſame ſolidity, and ſuſceptible of the ſame degree of motion with itſelf; and thus, being fixed there, it would be for ever after carried about by the motion of the vortex, without either approaching any nearer to, or receding from the ſun; and ſo would become a planet.

Suppoſing then all this, we are next to imagine, that our ſyſtem was at firſt divided into ſeveral vortices, in the center of each of which was a lucid ſpherical body; and that ſome of theſe being gradually incruſtated, were ſwallowed up by others which were larger, and more powerful, till at laſt they were all deſtroyed, and ſwallowed up by the biggeſt ſolar vortex; except ſome few which were thrown off in right lines from one vortex to another, and ſo become comets.

But this doctrine of vortices is at beſt, merely hypothetical. It does not pretend to ſhew by what laws and means the celeſtial motions are really affected, ſo much as by what means they poſſibly might, in caſe it ſhould have ſo pleaſed the Creator. But we have another principle which accounts for the ſame phænomena, as well, nay, better, than that of vortices; and which we plainly find has an actual exiſtence in the nature of things; and this is gravity, or the weight of bodies.

The vortices then ſhould be caſt out of philoſophy, were it only that two different adequate cauſes of the ſame phænomena are inconſiſtent.

But we have other objections againſt it. For, 1. If the bodies of the planets and comets be carried round the ſun in vortices, the bodies of the parts of the vortex immediately inveſting them, muſt move with the ſame velocity, and in the ſame direction; and beſides, muſt have the ſame denſity, or the ſame vis inertiæ. But it is evident that the planets and comets move in the very ſame parts of the heavens, with different velocity and in different directions. It follows, therefore, that theſe parts of the vortex muſt revolve at the ſame time in different directions, and with different velocities; ſince one velocity and direction will be required for the paſſage of the planets, and another for that of comets.

2. If it were granted that ſeveral vortices were contained in the ſame ſpace, do penetrate each other, and revolve with divers motions; ſince thoſe motions muſt be comformable to thoſe of the bodies which are perfectly regular, and performed in conic ſections; it may be aſked, how they ſhould have been preſerved entire to ſo many ages, and not diſturbed nor confounded by the adverſe actions and ſhocks of ſo much matter as they meet withal?

3. The number of comets is very great and their motions perfectly regular, obſerving the ſame laws with the planets, and moving in conical orbits, which are exceedingly excentric. Accordingly they move every way, and to all parts of the heavens, freely pervading the planetary regions, and going frequently contrary to the order

order of the ſigns; which would be impoſſible, unleſs theſe vortices were away.

4. If the planets move round the ſun in vortices, thoſe parts of vortices next the planets, we have already obſerved, would be equally denſe with the planets themſelves, conſequently, the vortical matter, contiguous to the perimeter of the earth's orbit, would be as dénſe as the earth itſelf: and that between the orbits of the earth and Saturn, it muſt be as denſe or denſer. For a vortex cannot maintain itſelf, unleſs the more denſe parts be in the center, and the leſs denſe towards the circumference; and, ſince the periodical times of the planets are in a ſeſquialterate ratio of their diſtances from the ſun, the parts of the vortex muſt be in the ſame ratio. Whence it follows, that the centrifugal force of the parts will be reciprocally as the ſquares of the diſtances. Such, therefore, as are at a greater diſtance from the center, will endeavour to recede therefrom with the leſs force. Accordingly, if they be leſs denſe, they muſt give way to the greater force, whereby the parts nearer the center endeavour to riſe. Thus the more denſe will riſe, and the leſs denſe deſcend; and thus there will be a change of places, till the whole fluid matter of the vortex be ſo adjuſted, as it may reſt in æquilibrio.

Thus will the greateſt part of the vortex without the earth's orbit, have a degree of denſity and inactivity, not leſs than that of the earth itſelf. Whence the comets muſt meet with a very great reſiſtance, which is contrary to all appearances.

The doctrine of vortices, Sir Iſaac Newton obſerves, labours under many difficulties: for a planet to deſcribe areas proportional to the times, the periodical times of the vortex ſhould be in a duplicate ratio of their diſtances from the ſun; and for the periodical time of the planet to be a ſeſquiplicate proportion of their diſtances from the ſun, the periodical times of the parts of the vortex ſhould be in the ſame proportion of their diſtances: and, laſtly, for the leſſer vortices about Jupiter, Saturn, and the other planets, to be preſerved, and ſwim ſcarcely in the ſun's vortex, the periodical times of the parts of the ſun's vortex ſhould be equal. None of which proportions are found to obtain in the revolutions of the ſun and planets around their axis.

Beſides, the planets, according to this hypotheſis, being carried about the ſun in ellipſes, and having the ſun in the umbilicus of each figure, by lines drawn from themſelves to the ſun, do always deſcribe areas proportionable to the times of their revolutions; which that author ſhews the parts of no vortex can do.

Again, Dr. Keil proves, in his Examination of Burnet's Theory, that if the earth were carried in a vortex, it would move faſter in the proportion of three to two, when it is in Virgo, than when it is in Piſces; which all experience proves to be falſe.

VOTE, the ſuffrage or reſolve of each of the members of an aſſembly, where any affair is to be carried by a majority; but more particularly uſed for the reſolves of the members of either houſe of parliament. See PARLIAMENT.

VOTIVE MEDALS, thoſe on which are expreſſed the vows of the people for the emperors or empreſſes. See MEDAL.

VOUCHER, in law, is a perſon called into court, to make good another's warranty, who is either to defend the right againſt the demandant, or yield him other lands to the value, &c.

This extends to lands or tenements of freehold or inheritance, but not to any thing perſonal or mixed.

Here he that voucheth is called the voucher, and the perſon that is vouched is called the vouchee. There is alſo a foreign voucher when the tenant impleaded in a particular juriſdiction, voucheth one to warranty in ſome other county, out of the juriſdiction of that court, and prays that he may be ſummoned.

Voucher alſo ſignifies a receipt or acquittance in caſes of account.

VOW, a ſolemn and religious promiſe, or oath.

The uſe of vows is found in moſt religions. They made a conſiderable part of the pagan worſhip; being made, either in conſequence of ſome deliverance, under ſome preſſing neceſſity, or for the ſucceſs of ſome enterprize.

The uſe of vows is obſervable throughout the hiſtory of the Old Teſtament. When Jacob went into Meſopotamia, he vowed to God the tenth of all he poſſeſſed, and promiſed to offer it at Beth-el, to the honour of God. Jephthah's vow, and the fatal conſequences of it to his family, are well known. Samuel was vowed, or devoted, to the ſervice of the Lord. The Levitical law is very particular in laying down rules concerning the obſervation of vows; the ſubſtance of which, as underſtood and practiſed by the Jews, is as follows.

All vows were to be voluntary: nevertheleſs, if a perſon, who was wholly in his own power, made a vow, in a thing lawful and poſſible, and promiſed ſomething ſolemnly to God, either by a ſimple vow, or the addition of a ſolemn curſe, he was obliged to fulfil his vow: otherwiſe he was liable to be puniſhed by God for the robbery and injuſtice offered him. If he appointed no particular time for accompliſhing his vow, he was bound to do it inſtantly, leſt, by delay, he ſhould prove leſs able, or be unwilling to execute his promiſe, or perhaps forget it. If the thing devoted chanced to be loſt, during the delay, he was obliged to give the value of it.

Though no human power could abſolve or acquit from lawful vows once made, yet there were perſons appointed to judge, whether they were lawful or not, and to determine concerning their obligation: and, as a modern writer informs us, there is a traditional doctrine among the Jews, practiſed at this day, that if any perſon makes a vow, which afterwards he wiſhes unmade and repents of, and it be not to the prejudice of any third perſon that it ſhould be broken; in this caſe, he may go to a rabbin, or to any other three men, who, hearing the reaſons of his repentance, and approving them, have power to free him from the obligation, by ſaying, "Be thou abſolved from this vow;" and ſo he is diſcharged. But this caſuiſtical ſolution is expreſsly contrary to the letter of the law, which inſiſts upon the ſtrict execution of vows in things lawful; for which reaſon the Jewiſh doctors very prudentially adviſe their ſcholars not to accuſtom themſelves to vows, and be content to obey the precepts of the law, without laying any other bonds upon themſelves.

All perſons, who bound themſelves by vows, were ſuppoſed to be abſolutely at their own diſpoſal, and under no power, that had authority to make them void. Sons in the family of their father, and undiſpoſed of in marriage, and ſervants under the government of their maſters, had no power to vow, without the expreſs conſent of their ſuperiors.

But the Moſaical law is moſt explicit in directing women in the nature and execution of vows. It conſiders them in a threefold ſtate; before they are married, after marriage, and in their widowhood. If a maiden, in the family and under the government of her father, made a ſimple vow, or bound it by an oath, and her father, being acquainted therewith, did not diſallow her promiſe, ſhe was obliged by her vow, and it was not in his power afterwards to diſannul it: but if the father, upon notice of her vow, refuſed his conſent, though ſhe had bound it with an oath, it was entirely void, and ſhe contracted no guilt by her not performing it.

When a married woman, or one eſpouſed to a huſband, though ſtill in her father's houſe, made a vow; her huſband, under whoſe power ſhe then was, was to determine concerning it; and the caſe was exactly the ſame as that of a daughter under the authority of her father. If the huſband, after he had conſented, refuſed the woman the liberty of fulfilling her vow, ſhe was acquitted, and the guilt lay wholly at his door.

A widow, or a woman divorced, though ſhe returned to her father's houſe, who by that means might be ſuppoſed to recover his ancient right over her, yet remained perfectly at her own diſpoſal, and was obliged to ſtand to her vows.

The matter of theſe vows of women ſeldom extended to the devoting any part of their goods to the ſervice of the prieſts, or other ſacred purpoſes; but conſiſted ge-

nerally

nerally in abſtaining from ſuch and ſuch meats, though in themſelves lawful; or in binding themſelves to faſt upon other days, as well as upon the great day of expiation, which was the only faſt ordained by the law of Moſes. And this kind of vow was called a vow of prohibition or obligation.

There was another ſort of vow, called a vow of conſecration, that is, when any thing was devoted to the ſervice of the altar, the temple, or the prieſts, in which this diſtinction was obſerved, that, when a thing was devoted ſimply in ſuch words as theſe, "Let this thing be a devoted thing," it was always underſtood to be ſet apart wholly for the prieſts: but when there was an addition, that determined it to a certain uſe, as in this manner, "Let this be a thing devoted, offered by me, to holy uſes;" the thing devoted was then employed about the reparation of the temple, the ſacred veſſels, the garments of the prieſthood, or other holy purpoſes.

The vow of conſecration admitted of ſeveral degrees. The higheſt is what the law calls a ſingular or extraordinary vow, when a man vowed himſelf, or his children, wholly to the ſervice of God in the tabernacle; it being thought a ſingular inſtance of devotion and piety, to aſſiſt the prieſts in the meaneſt offices, ſuch as bringing in wood, carrying out aſhes, ſweeping away the duſt, and the like. However perſons, thus devoted, were not admitted to any part of the holy ſervice: but a value was ſet upon them by the prieſt, which was employed to holy uſes. The reaſon, why God would not accept of the perſons themſelves, as they deſired, but the value of them for his ſervice, ſeems to be, becauſe there was a ſufficient number of perſons peculiarly deſigned for the ſervice of the tabernacle. But that the prieſt might not either overvalue or undervalue any perſon, the law has expreſsly fixed the rates which he ſhould demand for their redemption. A man, from twenty years old to ſixty, was to be redeemed for fifty ſhekels of ſilver. This was the higheſt value, and not without reaſon; for from twenty to ſixty, men are the moſt able to do ſervice. Women, under the ſame reſtriction for age, were not able to be ſo uſeful as men; and therefore they were valued at no more than thirty ſhekels.

A parent had power to devote a child to the ſervice of God. If the child was a male, between the age of five years and twenty, the price of redemption was twenty ſhekels; if a female, ſhe was redeemed for ten. A child was not capable of being devoted before it was a month old: but then it might; and the price between that age, and five years old, was five ſhekels for the male, and three for the female. A man beyond ſixty was redeemed for no more than fifteen ſhekels, becauſe his labour then is almoſt paſt, and his life likely to be ſhort: a female was redeemed for ten.

If a perſon was ſo poor as not to be able to pay the prices of redemption abovementioned, the prieſt was to examine into his circumſtances and abilities, and, upon the beſt information, to ſet ſuch a rate upon him, as he was able to pay, without injuring himſelf or his family.

If a man vowed a clean beaſt to divine uſe, he had no power to alter it for any other beaſt or thing: if he preſumed to change what he had vowed, he was to be beaten, and both the beaſts were reputed holy. A devoted beaſt, that was unclean, and not fit for ſacrifice, was to be valued by the prieſt; and if the man who vowed it, was willing, he might redeem it at the price ſet upon it: but it was in his choice, either to leave the beaſt with the prieſt, or to pay the money ſet upon it.

Nothing vowed had the benefit of redemption, but what was ſet apart by a ſimple vow only: whatever was devoted with a cherem, or a curſe upon him that vowed, if he did not fulfil his engagement, remained irreverſibly and unalterably to the uſe to which it was ſanctified; and the perſon was accurſed, who applied it to any other purpoſe. Such devoted things were called moſt holy, and no one might touch them but the prieſts; and they were ſo ſtrictly applied to divine ſervice, that they could not be alienated either by ſale, redemption, commutation, donation, or any other way.

The Sanhedrim, or the whole congregation, had a power to devote their enemies to death, before they went to war with them, and ſuch of their own people who refuſed to obey the military laws. In this caſe, there was no redemption allowed; but the perſons ſo devoted were put to death.

Under the New Teſtament we ſee the practice of vows. St. Paul made a vow of Nazariteſhip, when he left the harbour of Cenchrea, in order to go to Jeruſalem. And, when he arrived at Jeruſalem, St. James adviſed him to join himſelf with four Judaizing Chriſtians, who had made the like vow.

Pilgrimages, and other acts of devotion, among Chriſtians, have, in all ages, been undertaken in conſequence of vows; and the monaſtic life is ſupported thereby, the religious obliging themſelves, by ſolemn vows, to chaſtity, poverty, obedience, and other obſervances.

The practice of devoting one's ſelf to the ſervice of ſome ſaint was formerly much in vogue, and is ſtill practiſed in ſeveral catholic countries. A yearly tribute was paid to the patron-ſaint; and the vaſſal often bound himſelf and his whole poſterity, or at leaſt his children.

VOWS, *Vota*, among the Romans, ſignified ſacrifices, offerings, preſents and prayers made for the Cæſars and emperors, particularly for their proſperity and the continuance of their empire. Theſe were at firſt made every five years, then every fifteen, and afterwards every twenty, and were called quinquennalia, decennalia, and vincennalia.

VOWEL, *Vocalis*, in grammar, a letter which affords a complete ſound of itſelf, or a letter ſo ſimple as only to need a bare opening of the mouth to make it heard, and to form a diſtinct voice.

The vowels are ſix in number, viz. A, E, I, O, U, Y, and are called vowels in contradiſtinction to certain other letters, which, depending on a particular application of ſome part of the mouth, as the teeth, lips, or palate, can make no perfect ſound without an opening of the mouth, that is, without the addition of a vowel, and therefore called conſonants.

Grammarians reckon alſo eight ſemi-vowels, viz. F, H, L, M, N, R, S, Z, ſo denominated becauſe they approach nearer a vowel in the pronunciation. Of theſe ſemi-vowels four, viz. L, M, N, R, are called liquid.

UPLAND, denotes high ground, or, as ſome call it, terra firma, by which it ſtands oppoſed to ſuch as is mooriſh, marſhy, or low.

The uplands lie either on the tops of hills, or on their ſides, or on the ſlopes of riſing grounds. They ſometimes have a ſandy ſoil, ſometimes a rocky, gravelly, or loamy one; and ſometimes they conſiſt of tough clay, or a black mould. They are uſed by the farmers either for grazing or corn, as they happen to be more moiſt or more dry; and this difference depends upon their ſituation and nature.

Thoſe lands which lie flat upon the tops of hills are uſually the drieſt, and thoſe which form the ſlopes or ſides are uſually the moiſteſt, becauſe of the wet that is continually ouzing through them. The chalky, and eſpecially the clayey ſoils in theſe places, are moſt of all ſubject to be wet, eſpecially in winter, becauſe they retain the moiſture a long time; though they have alſo the inconveniencies of the ſandy and rocky lands in the ſame ſituations, chapping in ſummer. The black mould, and the hazely loams in theſe places, are the beſt for corn, as well as for paſture, eſpecially if the latter eſcapes the common misfortune of being full of worms. Theſe lands neither are waſhy in winter, nor parch up in ſummer.

The upland meadows have ſome diſadvantages, as they often need mending or feeding, which thoſe that lie lower do not; but then they make amends for this in their hay, which is always much finer and ſweeter than that of the low-lands.

UPLOPER, a name given to one particular ſpecies of pigeon, called by Moore columba gutturoſa ſaliens.

It was firſt brought to England from Holland, and much reſembles that kind of pigeon called the Engliſh powter, but that it is ſmaller: its crop is very round, and in this it buries its bill. Its legs are very ſmall and ſlender, and its toes are ſhort, and cloſe together, on which it treads ſo nicely, that, when moving, any ſmall thing might be put under the ball of its foot. The pigeons of this ſpecies are generally all blue, all black, or all white, ſeldom or never pyed. They are very ſcarce in England, and in Holland have been valued at five and twenty guineas a pair.

They have their name from the Dutch word oplopen, which ſignifies to leap up; and it was thus named from its manner of approaching the hen, which is always by leaping upon her. *Moore's Columbarium.*

UPRIGHT, in architecture, a repreſentation or draught of the front of a building, called alſo an elevation or orthography.

UPRIGHT, in heraldry, is uſed in reſpect of ſhell fiſhes, as crevices, &c. when ſtanding erect in a coat. Inaſmuch as they want fins, they cannot, according to Guillim, be properly ſaid to be hauriant; that being a term appropriated to ſcaly fiſhes.

UPUPA, the hoopoe, in ornithology, a genus of birds with the beak arcuated, convex, compreſſed, and equal, and having a furrow running along each ſide of it; there is a creſt on the head, which is capable of folding back. This is an extremely ſingular bird, but it is ſo thick covered with feathers, that it appears large in proportion to its weight; the head is large, and ornamented with an elegant creſt; the eyes are ſmall, but very bright and piercing; the tail is between four and five fingers breadth long, in the middle of which there is an elegant ſpot of white, of the figure of a new moon; the back is variegated with black and white in an elegant manner; the legs are ſhort, and the outer toe is connected to the middle one ſome part of the way down, without the help of a membrane.

URACHUS, in anatomy, a membranous canal in the fœtus of quadrupeds in general, of a pyramidal figure, extended immediately from the fundus of the bladder to the navel, and after paſſing through this, it is by degrees enlarged, and makes its way into the allantois at right angles each way, or nearly ſo, and conveys the urine from the bladder into the cavity of this membrane. In the human fœtus, the whole urachus is not pervious, or very rarely ſo; it is uſually found ſolid, in form of a ligament. It ſcarce appears probable, therefore, that it ſerves the office of diſcharging the urine from the bladder in this as in the former caſe, and eſpecially as there is no ſuch membrane as the allantois in the human body, nor any cavity formed for the reception of ſo great a quantity of fluid.

URANOSCOPUS, the ſtar-gazer, in ichthyology, a ſpecies of trachinus, with numerous cirri on the under jaw.

This fiſh is of an extremely ſingular figure; the body is round, a little depreſſed, the back broad, the ſides prominent, and the belly ſomewhat flatted; the head is large and depreſſed; the mouth divided, as it were, into three ſpines under the tongue, and the lower jaw turning upwards; the eyes are large, and ſtand near one another, not on the ſides, but on the top of the head, ſo that the fiſh naturally looks ſtraight upwards; the iris is of a gold yellow, the pupil is of a bluiſh black, the noſtrils have each a double aperture, and are placed at ſome diſtance under the eyes; the whole head, and the coverings of the gills, are beſet with a great number of rough and ſharp tubercles; there are two back fins, the firſt has three prickly rays, the ſecond has fourteen; the pectoral fins have each ſixteen rays, the ventral ones have each five, and the pinna ani has thirteen.

URDE', or Urdée, in heraldry. A croſs urdé ſeems to be the ſame with what we otherwiſe call chleche, or chlechee.

UREDO, the blaſting or blighting of trees or herbs. See BLIGHT.

It is ſometimes uſed by phyſicians for an itching or burning of the ſkin.

URETERS, ουρητηρες, in anatomy, two membranaceous tubes or pipes, nearly cylindric in figure, and of about the thickneſs of a quill: but their diameter is very uncertain.

They ariſe from the kidneys, one from each, and terminate in the urinary bladder. At their origin in the kidneys, they are expanded into the form of a funnel, and this expanſion makes the pelvis of the kidneys. See the article PELVIS.

At their termination, which is in the hinder and lower part of the bladder, they paſs obliquely in between its membranes, and open into the bladder by very narrow orifices, and can admit nothing into them from the bladder. They are not ſtraight, but ſomewhat bent, ſo as to reſemble the letter *S*; their ſubſtance is membranaceous, and they are compoſed of three coats: the firſt, a common one, from the peritonæum; the ſecond, a thin muſcular one; and the third, a nervous one, covered with a lubricous humour; and in this there are ſometimes diſcovered glands. The blood veſſels and nerves come from the adjacent parts.

The uſe of the ureters is to receive the urine ſecreted in the kidneys from the pelvis, and to carry it to the urinary bladder. When theſe are obſtructed, a ſuppreſſion of urine is the conſequence; for there is no other way for the urine to get into the bladder but through them. They are often found of an unnatural ſize, owing to ſtones concreted from among the urine.

URETHRA, ουρηθρα, in anatomy, a membranaceous tube or canal, of a cylindric figure, ariſing from the neck of the bladder, and continued to the pudendum, ſerving to diſcharge and carry off the urine and ſemen.

The length of the urethra is very different in both ſexes. In man it is twelve or thirteen inches, from the neck of the bladder to the extremity of the glans. It is ſituated in a kind of narrow furrow, formed between the corpora cavernoſa, in the bottom or lower part of the penis. It does not run perfectly ſtraight, but is bent in a very ſingular manner. Its cavity is as large as that of a gooſe quill.

It is compoſed of two robuſt membranes, an exterior and interior; their ſubſtance is thin and tough, and between them there is a ſpongeous or cavernous matter, in which ſome authors pretend to have diſcovered glands, but this is uncertain.

The bulb of the urethra is that part of it next to the proſtatæ; it is much thicker than the reſt of the tube, and is about an inch long, and in ſome meaſure reſembles a walnut. It is of a thick and ſpongy texture.

The interior ſurface of the urethra is full of roundiſh and oblong foraminulæ and furrows, out of which there may often be preſſed a thick viſcous fluid, the uſe of which is to lubricate the urethra, and to defend it from the acrimony of the urine. See PENIS, &c.

The urethra or urinary paſſage in women, uſually called meatus urinarius, is ſituated ſtraight under the clitoris, and ſhews itſelf by a little eminence. Its length is about two fingers breadth; its diameter is greater than that in man, but ſomewhat narrower at the end than elſewhere. It is capable of great dilatation. There are in it certain little ducts, which convey to its inner ſurface a mucous humour, for lubricating and defending it from the acrimony of the urine, like thoſe in man; but their origin is uncertain.

URIM *and* THUMMIM, among the ancient Hebrews, a certain oracular manner of conſulting God, which was done by the high-prieſt dreſſed in his robes, and having on his pectoral, or breaſt-plate.

Various have been the ſentiments of commentators concerning the urim and thummim. Joſephus and ſeveral others maintain, that it meant the precious ſtones ſet in the high-prieſt's breaſt-plate, which, by ſome extraordinary luſtre, made known the will of God to thoſe who conſulted him.

Spencer believes, that the urim and thummim were two little golden figures ſhut up in the pectoral, as in a purſe, which gave reſponſes with an articulate voice. In ſhort, there are as many opinions concerning the urim and thummim, as there are particular authors that wrote about them.

The ſafeſt opinion, according to Broughton, ſeems to be, that the words urim and thummim ſignify ſome divine virtue and power, annexed to the breaſt-plate of the high-prieſt, by which an oraculous anſwer was obtained from God when he was conſulted by the high-prieſt; and that this was called urim and thummim, to expreſs the clearneſs and perfection which theſe oracular anſwers always carried with them; for urim ſignifies light, and thummim, perfection; theſe anſwers not being imperfect and ambiguous, like the heathen oracles, but clear and evident.

The uſe made of the urim and thummim was to conſult God, in difficult caſes, relating to the whole ſtate of Iſrael; and ſometimes in caſes relating to the king, the ſanhedrim, the general of the army, or ſome other great perſonage.

URINAL, in medicine, a veſſel fit to receive and hold urine, and uſed accordingly for the convenience of ſick perſons.

It is uſually of glaſs, and crooked; and ſometimes it is filled with milk to aſſwage the pain of the gravel.

URINAL, in chemiſtry, is an oblong glaſs veſſel, cloſed for making ſolutions, and ſo called from its reſemblance to the glaſſes in which urine is ſet to ſettle for the inſpection of the phyſician. See the preceding article.

URINARIA FISTULA, the urinary paſſage, or urethra. See URETHRA.

URINE, *Urina*, a ſerous and ſaline fluid, of a citron colour, ſeparated from the blood, and carried by the emulgent arteries to the kidneys, from whence it deſcends to the bladder by the ureters, and is, from time to time, emitted thence by the canal of the urethra.

The urine is therefore the ſeroſity of the blood, but not pure, for it is loaded with ſaline, ſulphureous, and terreſtrial particles, of which it is the menſtruum and the vehicle. The ſides of the bladder are guarded by a mucilaginous fluid, excreted by the glands which are between its coats, by which means the urinous ſalts make the leſs impreſſion upon it. This fluid forms the glair, which falls to the bottom of the veſſel when a perſon is afflicted with the ſtone.

It is obſervable, that there are three ſorts of ſubſtances differently placed in the urine, viz. the nubecula, the encœorema, and the hypoſtaſis. The nubecula is a ſort of pellicle which ſwims on the top of the urine, and conſiſts of the ſaline and fibrous particles of the blood mixed with the ſeroſity. When it is expoſed to the fire, it changes to a cruſtaceous ſubſtance. The encœorema, or ſuſpenſion, is a white, light, ſpongious matter which ſwims in the middle of the urine, conſiſting of particles of a different nature. The hypoſtaſis, or ſediment, is a ſaline, ſulphureous, and terreſtrial matter, which precipitates to the bottom of the urine.

The urine of four-footed beaſts is troubled and muddy, that of men is more clear and limpid. In infants it is more pale and thick than that of middle aged perſons. In the very old it is more clear, thin, and has not ſo much colour. In hot, bilious conſtitutions, it is more of a ſaffron colour: in the cold and pituitous, pale. Wine-drinkers have it of a higher colour, and more thick: in thoſe that uſe much exerciſe it is little and red: in the idle it is pale, with a large ſediment. After meals it is copious, inſipid, light, raw, and without ſmell: after long faſting, it is of a higher colour, acrid, and little. Thoſe that ſweat much make little water, which is more muddy and yellow. Diſeaſes cauſe a remarkable change in the urine. Light, thin, watery urine, ſhews the perſon to be afflicted with internal ſpaſms, the hyſteric paſſion, the hypochondriac pains, the cardialgia, the ſtone or gravel, or convulſive colic. In diſeaſes of the head, ſuch as the vertigo, phrenſy, madneſs, melancholy, and epilepſy, the urine is always thin and light. It is likewiſe the ſame in the more grievous afflictions of the nerves from poiſon or worms. This ſtate of the urine not only happens in the fits, but ſome days before and after.

When the urine is thin, aqueous, and always white, it preſages danger in obſtinate diſeaſes: if it is copious in the ſtate of fevers, and before the criſis, it portends a phrenſy. In internal inflammations it is always dangerous, the more copious the worſe. After a dyſentery, a ſpotted fever, or the ſmall-pox, this kind of urine is common. In a cachexy, leucophlegmatia, enormous bleedings in the beginning of an anaſarca, in the green-ſickneſs, in a ſuppreſſion of the menſes, the urine is crude, turbid, pale, greeniſh, or of a light citron-colour, and copious. In all preternatural febrile heats, the urine is yellow or red, and in ſmall quantities: ſuch kind of urine as is more or leſs red, or thin and light, or thick and heavy, is uſually in intermitting and continual fevers. In the fit, that is, in its exacerbation or ſtate, the urine is thin, clear, and without ſediment. In an ardent and bilious fever, the urine is generally pellucid, but of a flame-colour. In intermittents after the fit, and on the well day, it is thick, and depoſits a ſediment. If this happens in continual fevers after the criſis, it ſhews the fever to be ended. If the ſediment is of a roſy or purple-colour, it ſhews the blood is in fault, as is evident in continual fevers. When it is intenſely yellow, it diſcovers that the bile is in fault. When it is brown or black, there is plenty of black bile, as in a ſcorbutic or miliary fever, and in quartans of a dangerous nature. When it is very plentiful, and full of viſcid and crude humours, in replete, obeſe, and ſpongy bodies, it ſhews the obſtinacy of an intermitting fever.

As it is a good ſign when the urine is thick and depoſits a ſediment, in fevers; ſo, on the contrary, if there is no ſediment in intermitting fevers, but the urine continues clear, and lets fall no ſediment in the cold fit, it is a very bad ſign. If, after the fit, it has no ſediment, but is pellucid, it is a very bad omen. In all inflammatory fevers, if the urine is clear and of a purple colour, or brown, and of a deep colour, frothy and without ſediment, it is a bad ſign. Likewiſe, it is always obſerved, that in a continual fever, if the urine is turbid, and does not grow clear either by the fire or reſt, nor depoſits a ſediment, it is a very dangerous preſage; it is likewiſe very bad, when in continual fevers, it is thick on the firſt days, and in the remainder, eſpecially the critical days, it is thin and without ſediment. In the decline of catarrhal fevers, and in the ſmall-pox and meaſles, if the urine was clear and aqueous, but is now thick and high-coloured, with a ſediment, it is a certain ſign that the diſeaſe remits.

In conſumptions, and all other violent and chronical diſeaſes, if the urine is thick, high-coloured, and a dark red, with a copious ſediment, and a fatneſs ſwims upon the urine, and adheres to the ſides of the urinal, the body at the ſame time waſting away, it is a ſign of a ſlow hectic fever, which is generally fatal. The like danger is threatened when in dropſical perſons the urine is like that of hectics, for its ſcarcity is a ſign that the lympha is extravaſated into ſome cavity or porous ſubſtance; and if the colour is of a deep red, with a groſs ſediment, it ſhews the inteſtine motion and heat diſſolves the blood, that the liver is obſtructed; whence a bilious ſordes is ſeparated thereform.

In chronical diſeaſes, without a fever, when the urine is thick, high-coloured, and of a reddiſh brown, as well as heavy, as in the confirmed ſcurvy, gout, ſcorbutic palſy, and in extreme old age, as alſo in a nephritic paſſion, when the pains ceaſe, as well as in the yellow and black jaundice, it ſhews a plenty of ſaline and ſulphureous excrementitious parts, wherewith the blood and humours abound, and are not duly ſecreted therefrom, by reaſon of an obſtruction of the liver. Willis has obſerved, that patients dying of the ſcurvy have had their livers almoſt without blood, and like a cow's udder. In ſome the gall-bladder was either empty or full of ſtones, or very bitter filth.

When the urine is thick, of a deep colour, and dyes linen yellow, it is a ſign that the bile is obſtructed, or the duct conſtricted with a ſpaſm, whence the paſſage of the bile into the duodenum is hindered: whence it regurgitates by the lymphatic veſſels into the blood and lympha, and produces a jaundice, which proceeds from an impeded ſecretion of the bile in the liver.

Sometimes the urine is imbued with an oily matter, and is made without noiſe, there are various colours on the

It was firſt brought to England from Holland, and much reſembles that kind of pigeon called the Engliſh powter, but that it is ſmaller: its crop is very round, and in this it buries its bill. Its legs are very ſmall and ſlender, and its toes are ſhort, and cloſe together, on which it treads ſo nicely, that, when moving, any ſmall thing might be put under the ball of its foot. The pigeons of this ſpecies are generally all blue, all black, or all white, ſeldom or never pyed. They are very ſcarce in England, and in Holland have been valued at five and twenty guineas a pair.

They have their name from the Dutch word oplopen, which ſignifies to leap up; and it was thus named from its manner of approaching the hen, which is always by leaping upon her. *Moore's Columbarium.*

UPRIGHT, in architecture, a repreſentation or draught of the front of a building, called alſo an elevation or orthography.

UPRIGHT, in heraldry, is uſed in reſpect of ſhell fiſhes, as crevices, &c. when ſtanding erect in a coat. Inaſmuch as they want fins, they cannot, according to Guillim, be properly ſaid to be hauriant; that being a term appropriated to ſcaly fiſhes.

UPUPA, the hoopoe, in ornithology, a genus of birds with the beak arcuated, convex, compreſſed, and equal, and having a furrow running along each ſide of it; there is a creſt on the head, which is capable of folding back. This is an extremely ſingular bird, but it is ſo thick covered with feathers, that it appears large in proportion to its weight; the head is large, and ornamented with an elegant creſt; the eyes are ſmall, but very bright and piercing; the tail is between four and five fingers breadth long, in the middle of which there is an elegant ſpot of white, of the figure of a new moon; the back is variegated with black and white in an elegant manner; the legs are ſhort, and the outer toe is connected to the middle one ſome part of the way down, without the help of a membrane.

URACHUS, in anatomy, a membranous canal in the fœtus of quadrupeds in general, of a pyramidal figure, extended immediately from the fundus of the bladder to the navel, and after paſſing through this, it is by degrees enlarged, and makes its way into the allantois at right angles each way, or nearly ſo, and conveys the urine from the bladder into the cavity of this membrane. In the human fœtus, the whole urachus is not pervious, or very rarely ſo; it is uſually found ſolid, in form of a ligament. It ſcarce appears probable, therefore, that it ſerves the office of diſcharging the urine from the bladder in this as in the former caſe, and eſpecially as there is no ſuch membrane as the allantois in the human body, nor any cavity formed for the reception of ſo great a quantity of fluid.

URANOSCOPUS, the ſtar-gazer, in ichthyology, a ſpecies of trachinus, with numerous cirri on the under jaw.

This fiſh is of an extremely ſingular figure; the body is round, a little depreſſed, the back broad, the ſides prominent, and the belly ſomewhat flatted; the head is large and depreſſed; the mouth divided, as it were, into three ſpines under the tongue, and the lower jaw turning upwards; the eyes are large, and ſtand near one another, not on the ſides, but on the top of the head, ſo that the fiſh naturally looks ſtraight upwards; the iris is of a gold yellow, the pupil is of a bluiſh black, the noſtrils have each a double aperture, and are placed at ſome diſtance under the eyes; the whole head, and the coverings of the gills, are beſet with a great number of rough and ſharp tubercles; there are two back fins, the firſt has three prickly rays, the ſecond has fourteen; the pectoral fins have each ſixteen rays, the ventral ones have each five, and the pinna ani has thirteen.

URDE', or Urdée, in heraldry. A croſs urdé ſeems to be the ſame with what we otherwiſe call chleche, or chlechee.

UREDO, the blaſting or blighting of trees or herbs. See BLIGHT.

It is ſometimes uſed by phyſicians for an itching or burning of the ſkin.

URETERS, ουρητηρες, in anatomy, two membranaceous tubes or pipes, nearly cylindric in figure, and of about the thickneſs of a quill: but their diameter is very uncertain.

They ariſe from the kidneys, one from each, and terminate in the urinary bladder. At their origin in the kidneys, they are expanded into the form of a funnel, and this expanſion makes the pelvis of the kidneys. See the article PELVIS.

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It is obſervable, that there are three ſorts of ſubſtances differently placed in the urine, viz. the nubecula, the encœorema, and the hypoſtaſis. The nubecula is a ſort of pellicle which ſwims on the top of the urine, and conſiſts of the ſaline and fibrous particles of the blood mixed with the ſeroſity. When it is expoſed to the fire, it changes to a cruſtaceous ſubſtance. The encœorema, or ſuſpenſion, is a white, light, ſpongious matter which ſwims in the middle of the urine, conſiſting of particles of a different nature. The hypoſtaſis, or ſediment, is a ſaline, ſulphureous, and terreſtrial matter, which precipitates to the bottom of the urine.

The urine of four-footed beaſts is troubled and muddy, that of men is more clear and limpid. In infants it is more pale and thick than that of middle aged perſons. In the very old it is more clear, thin, and has not ſo much colour. In hot, bilious conſtitutions, it is more of a ſaffron colour: in the cold and pituitous, pale. Wine-drinkers have it of a higher colour, and more thick: in thoſe that uſe much exerciſe it is little and red: in the idle it is pale, with a large ſediment. After meals it is copious, inſipid, light, raw, and without ſmell: after long faſting, it is of a higher colour, acrid, and little. Thoſe that ſweat much make little water, which is more muddy and yellow. Diſeaſes cauſe a remarkable change in the urine. Light, thin, watery urine, ſhews the perſon to be afflicted with internal ſpaſms, the hyſteric paſſion, the hypochondriac pains, the cardialgia, the ſtone or gravel, or convulſive colic. In diſeaſes of the head, ſuch as the vertigo, phrenſy, madneſs, melancholy, and epilepſy, the urine is always thin and light. It is likewiſe the ſame in the more grievous afflictions of the nerves from poiſon or worms. This ſtate of the urine not only happens in the fits, but ſome days before and after.

When the urine is thin, aqueous, and always white, it preſages danger in obſtinate diſeaſes: if it is copious in the ſtate of fevers, and before the criſis, it portends a phrenſy. In internal inflammations it is always dangerous, the more copious the worſe. After a dyſentery, a ſpotted fever, or the ſmall-pox, this kind of urine is common. In a cachexy, leucophlegmatia, enormous bleedings in the beginning of an anaſarca, in the green-ſickneſs, in a ſuppreſſion of the menſes, the urine is crude, turbid, pale, greeniſh, or of a light citron-colour, and copious. In all preternatural febrile heats, the urine is yellow or red, and in ſmall quantities: ſuch kind of urine as is more or leſs red, or thin and light, or thick and heavy, is uſually in intermitting and continual fevers. In the fit, that is, in its exacerbation or ſtate, the urine is thin, clear, and without ſediment. In an ardent and bilious fever, the urine is generally pellucid, but of a flame-colour. In intermittents after the fit, and on the well day, it is thick, and depoſits a ſediment. If this happens in continual fevers after the criſis, it ſhews the fever to be ended. If the ſediment is of a roſy or purple-colour, it ſhews the blood is in fault, as is evident in continual fevers. When it is intenſely yellow, it diſcovers that the bile is in fault. When it is brown or black, there is plenty of black bile, as in a ſcorbutic or miliary fever, and in quartans of a dangerous nature. When it is very plentiful, and full of viſcid and crude humours, in replete, obeſe, and ſpongy bodies, it ſhews the obſtinacy of an intermitting fever.

As it is a good ſign when the urine is thick and depoſits a ſediment, in fevers; ſo, on the contrary, if there is no ſediment in intermitting fevers, but the urine continues clear, and lets fall no ſediment in the cold fit, it is a very bad ſign. If, after the fit, it has no ſediment, but is pellucid, it is a very bad omen. In all inflammatory fevers, if the urine is clear and of a purple colour, or brown, and of a deep colour, frothy and without ſediment, it is a bad ſign. Likewiſe, it is always obſerved, that in a continual fever, if the urine is turbid, and does not grow clear either by the fire or reſt, nor depoſits a ſediment, it is a very dangerous preſage; it is likewiſe very bad, when in continual fevers, it is thick on the firſt days, and in the remainder, eſpecially the critical days, it is thin and without ſediment. In the decline of catarrhal fevers, and in the ſmall-pox and meaſles, if the urine was clear and aqueous, but is now thick and high-coloured, with a ſediment, it is a certain ſign that the diſeaſe remits.

In conſumptions, and all other violent and chronical diſeaſes, if the urine is thick, high-coloured, and a dark red, with a copious ſediment, and a fatneſs ſwims upon the urine, and adheres to the ſides of the urinal, the body at the ſame time waſting away, it is a ſign of a ſlow hectic fever, which is generally fatal. The like danger is threatened when in dropſical perſons the urine is like that of hectics, for its ſcarcity is a ſign that the lympha is extravaſated into ſome cavity or porous ſubſtance; and if the colour is of a deep red, with a groſs ſediment, it ſhews the inteſtine motion and heat diſſolves the blood, that the liver is obſtructed; whence a bilious ſordes is ſeparated thereform.

In chronical diſeaſes, without a fever, when the urine is thick, high-coloured, and of a reddiſh brown, as well as heavy, as in the confirmed ſcurvy, gout, ſcorbutic palſy, and in extreme old age, as alſo in a nephritic paſſion, when the pains ceaſe, as well as in the yellow and black jaundice, it ſhews a plenty of ſaline and ſulphureous excrementitious parts, wherewith the blood and humours abound, and are not duly ſecreted therefrom, by reaſon of an obſtruction of the liver. Willis has obſerved, that patients dying of the ſcurvy have had their livers almoſt without blood, and like a cow's udder. In ſome the gall-bladder was either empty or full of ſtones, or very bitter filth.

When the urine is thick, of a deep colour, and dyes linen yellow, it is a ſign that the bile is obſtructed, or the duct conſtricted with a ſpaſm, whence the paſſage of the bile into the duodenum is hindered: whence it regurgitates by the lymphatic veſſels into the blood and lympha, and produces a jaundice, which proceeds from an impeded ſecretion of the bile in the liver.

Sometimes the urine is imbued with an oily matter, and is made without noiſe, there are various colours on the

the ſurface, chiefly bluiſh, and it adheres ſo ſtrongly to the ſides of the urinal, that it cannot be waſhed off with a lixivious liquor. This is a ſign of the colliquation of the fat: it ſhews a conſumption, an atrophy, and an hectic. Sometimes it is obſervable in fevers, and the oleous matter is more plentiful in proportion to the fatneſs of the body.

When the urine abounds too much with a tartareous matter, which is known by its adhering to the ſides of the chamber-pot, it is a ſign of a diſpoſition to the gravel and ſtone. When there is a ſmall ſand in the urine, it ſhews thoſe diſorders to be actually preſent. Sometimes ſhining yellow cryſtals are ſeen on the ſides of the pot, which is a ſign of arthritic or rheumatic pains. When the urine is bloody or whitiſh, from a mixture of pus loaded with a glutinous, thick, tenacious matter, of a bad ſmell, which ſinks to the bottom, and does not diſſolve by the agitation of the veſſel, it is a certain ſign of an ulcer in the kidneys or bladder. Sometimes, in the ſtone and ulcer of the bladder, it is like the white of an egg, and ſo tenacious that it will not divide, but fall from the veſſel at once.

In a chronical and malignant gonorrhœa, not only the proſtatæ, but often the bladder, is ulcerated; whence a thick and turbid urine, with a copious ſediment, which when thrown on the fire, has a moſt fœtid ſmell. Likewiſe, in the ſtone in the bladder, this, or its ſphincter, is ſo eroded, that the urine is thick and branny, with ſmall caruncles and filaments, which the vulgar take for worms. In the ſtrangury, there is a frequent ſtimulus to make water, which is little and muddy, ſharp and ſalt, with filaments; and then there is ſome ſpaſmodic diſorder affects the ſphincter. If blood is mixed with the urine, like the waſhings of fleſh or red-wine, but falls to the bottom, of a purple colour, it proceeds from the kidneys; but if it be of a browniſh black, it comes from the veins of the bladder.

Incontinence of URINE. This is a term uſed by medical writers to expreſs an involuntary excretion of this liquor, whether it be inceſſantly, or in larger quantities at different intervals. This is of two kinds: in the one it is only in the night, in the time of ſleep; and this ariſes merely from careleſſneſs, and a bad habit: in the other, it depends on a paralytic affection of the ſphincter of the bladder: and in this caſe it drops away continually from the patient; and this is therefore called by ſome a ſtillicidium. Authors alſo divide an incontinence of urine into the idiopathic and ſymptomatic: the idiopathic is a diſeaſe in itſelf, and depends upon the preceding cauſes; the ſymptomatic happens to different perſons on different occaſions, as a ſymptom of other complaints. It is common to dying perſons; it is alſo very frequent to women who are big with child, and ſometimes happens from violent ſneezing, coughing, or laughing. The voiding of the urine involuntarily, and in the ſleep, in infants, is not to be accounted a diſeaſe; but when this cuſtom continues with them as they grow up, from idleneſs, or ill habit, it is at length to be conſidered as a diſeaſe, as they are by no means able to help it. Women who have ſuffered much in childbirth are often ſubject to an incontinence of urine afterwards, eſpecially perſons who have had their firſt child at an advanced age. People in years, who are ſubject to paralytic complaints, are alſo often afflicted with this troubleſome complaint; and many who have been cut for the ſtone by perſons not ſufficiently ſkilled in the operation. Perſons ſubject to the piles alſo ſometimes fall into it, from the ſuppreſſions of their uſual diſcharges, and ſometimes from the tumours becoming fiſtulous, and reaching to the neck of the bladder. Impoſthumes of the bladder will alſo occaſion it, and violent external injuries.

An incontinence of urine, which happens only in the night, and is merely cauſed by a bad habit, and not of long ſtanding, uſually admits of a cure; but the ſtillicidiums of urine, from paralytic diſorders of the ſphincter of the bladder, are very rarely cured, eſpecially when they have been fixed ſome time upon the perſon. The involuntary voiding the urine in the night, in children, is to be cured, in a great meaſure, with puniſhment for the neglect, and by denying them much liquids after dinner time; by a proper diet; the avoiding all diuretics, and the making water immediately before going to bed; and when it has gone ſo far, that the tone of the parts is injured, the uſual ſtrengthening medicines are the proper method of curing; in this caſe, maſtich, amber, nutmeg, and cinnabar, are found to be of great ſervice, and pills or powders compounded of them, are an excellent general remedy to be given in ſmall doſes, two or three times a day. Externally, it is very proper to uſe by way of fomentation, decoctions of roſemary, ſage, ſerpyllum, marjoram, and the like warm herbs in red wine. When the diſeaſe is occaſioned by an impoſthume or ulcer in the neck of the bladder, balſamics are to be given, as maſtich, gum-juniper, and boiled turpentine; but when it is owing to injuries received in child-birth, the manual operation of the ſurgeon is uſually to be preferred to all internal medicines.

Difficulty, or *Suppreſſion*, *of* URINE.—When the urine of children is ſuppreſſed by viſcid humours which obſtruct the kidneys, or from the relaxed tone of the bladder, or from ſpaſmodic conſtrictions, producing pains, convulſions, and other diſorders, you may give them half a ſcruple of ſome neutral ſalt, ſuch as tartar vitriolate, arcanum duplicatum, and the like; or the ſame quantity of the ſeeds, Ray ſays the flowers, of muſcus clavellatus, lycopodium, or club-moſs, in parſley water; it being diuretic and antiſpaſmodic. The pubes may likewiſe be anointed with oil of juniper mixed with oil of amber and aniſeed; and then a cataplaſm of roaſted onions may be laid on hot. Theſe things are likewiſe good when there is ſmall ſtones, which they expel. But if theſe fail, and the ſymptoms are urgent, a catheter muſt be introduced into the bladder; which is much eaſier in girls than boys.

For the diabetes, or that diſeaſe wherein the urine comes away crude, exceeding the quantity of the liquids drank, ſee the article DIABETES.

URINE, in agriculture, is of excellent uſe as a manure.

The experienced in agriculture and gardening, prefer urine for land, trees, &c. before dung, as penetrating better to the roots; and removing divers infirmities of plants.

The decay of the ancient Kentiſh pippins, is a thing much complained of; and Mr. Mortimer obſerves, they will be quite loſt, unleſs ſome perſons ſet themſelves to the ancient way of culture; which, as all ancient graziers and gardeners know, was by waſhing the moſſy, worm-eaten, cankered, and unſound trees, two or three times in the month of March, with the urine of oxen, &c. gathered in earthen veſſels, placed under the planks of the ſtalls wherein they were fatted.

In Holland, and in divers other parts, they preſerve the urine of their beaſts, &c. with as much care as their dung. Mr. Hartlib, Sir Hugh Plat, Mr. Mortimer, &c. make a common complaint, that ſo great an improver of land, and ſo remarkable a ſtrengthener of manure, ſhould be ſo much diſregarded among us.

URINOUS SALTS, are the ſame with what we otherwiſe call alcali ſalts, or alcalies.

URN, *Urna*, a kind of vaſe, of a roundiſh form, but biggeſt in the middle, like the common pitchers, now ſeldom uſed but in the way of ornament over chimney-pieces, in buffets, &c. The great uſe of urns among the ancients was to preſerve the aſhes of the dead after they were burnt; for which reaſon they were called cineraria, and urnæ cinerariæ, and were placed ſometimes under the tombſtone whereon the epitaph was cut, and ſometimes in vaults in their own houſes. Urns were alſo uſed at their ſacrifices to put liquid things in.

URN was alſo a Roman meaſure for things liquid. See MEASURE.

UROCRITERIUM, caſting of water; or giving judgment on diſeaſes by the ſight of urine. See URINE.

URSA, the Bear, in aſtronomy, a name common to two conſtellations of the northern hemiſphere, near the pole, diſtinguiſhed by major and minor. The urſa major, or the great bear, according to Ptolemy's catalogue, conſiſts of thirty-five ſtars: according to Tycho's of fifty-

fifty-ſix; but in the Britannic catalogue we have two hundred and fifteen.

The urſa minor, or little bear, called alſo Charles's wain; and by the Greeks cynoſura; by its neighbourhood to the north pole, gives the denomination ἀρκτος, bear, thereto. Ptolemy and Tycho make it to conſiſt of eight ſtars, but Flamſtead of fourteen.

URSULINES, in church hiſtory, an order of nuns, founded originally by St. Angela of Breſcia, in the year 1537, and ſo called from St. Urſula, to whom they were dedicated. They obſerve the rules of St. Auguſtine, and are chiefly noted for taking on them the education and inſtruction of young maids; their monaſteries are a kind of ſchools where young ladies of the beſt families receive their education. The habit of theſe religious is a gown of black ſerge, or other ſtuff, tied about with a girdle of black leather. The Urſulines are ſpread chiefly over France and Italy; and their different obſervances in the ſeveral monaſteries make them, in truth, ſo many diſtinct religious orders.

URTICA, nettle, in botany, a genus of plants, the flower of which is of the apetalous kind, being compoſed only of a number of ſtamina placed in a cup. Theſe are barren, and the ſeeds grow on other plants of the ſame ſpecies, which have no flowers, and are contained either in round globules, or bivalve capſules, or in long tufts.

The roots of the common nettle are much recommended in medicine; they are powerful diuretics, and are ſaid to have great virtues againſt the ſtone and gravel. They cleanſe the blood, and are ſaid to be of great ſervice in hæmorrhages of all kinds, particularly in ſpittings of blood, and overflowings of the menſes. Authors add to this, that they are ſpecifics by way of antidote againſt the poiſon of henbane and hemlock; but this we are not ſo well aſſured of. The young ſhoots of the plant are eaten in the ſpring, as good againſt ſcorbutic complaints. See NETTLE.

URTICA *Marina*, in zoology, the name of a remarkable genus of fiſhes, ſo called from their affecting the ſkin, on touching them, with a painful ſenſation like that of ſtinging of nettles. Theſe are an animal of the loweſt claſs, and have by many been reckoned among thoſe creatures called zoophytes, or plant animals, as ſuppoſed to partake of the nature of vegetables and of animals. Some of the ſpecies of this fiſh are found looſe upon the ſmooth ſhores, and ſome fixed to the rocks which are always covered with water. M. Reaumur obſerves alſo, that many of the ſpecies have no property of ſtinging, or cauſing any painful ſenſation of the fleſh.

USANCE, *Uſo*, in commerce, is a determinate time fixed for the payment of bills of exchange, reckoned either from the day of the bills being accepted, or from the day of their date; and thus called, becauſe regulated by the uſage and cuſtom of the places whereon they are drawn.

Bills of exchange are drawn at one or more uſances, either from ſight or from date. The term is longer or ſhorter, according to the different countries. Uſance from London to any part of France, is thirty days; this being declared to be a month, in regard to the exchanges in this kingdom, whether the month has more or fewer in it. Uſance from London to Hamburgh, Amſterdam, Rotterdam, Middleburgh, Antwerp, Brabant, Zealand, and Flanders, and from theſe places to London, is one calendar month after the date of the bill. Uſance from London to Spain and Portugal, and from theſe places to London, is two calendar months after date. Uſance from London to Genoa, Leghorn, Milan, Venice, and Rome, and from theſe places to London, is three months. See EXCHANGE.

Uſance of Amſterdam upon Italy, Spain, and Portugal, is two months: upon France, Flanders, Brabant, Geneva, and upon any place in the ſeven United Provinces, is one month. Upon Francfort, Nuremburgh, Vienna, Augſburgh, Cologne, Leipzic, and other places of Germany, as alſo upon Hamburgh and Breſlaw, is fourteen days after ſight: two uſances twenty-eight, and half uſance ſeven.

Uſance from Dantzic, Coningſberg, and Riga, upon Amſterdam, is at one month after ſight; though it is common to draw from the firſt at forty days date, and from the others at forty one, but oftener at ten and eleven. And from Amſterdam on the ſaid places at a month's date, without mentioning uſance; though ſometimes at forty and forty-one days; and ſometimes on Breſlaw at ſix weeks date. Moſt nations have generally agreed to allow the acceptor of a bill ſome ſmall time for payment beyond that mentioned in the bill, termed days of grace or reſpite; but they generally diſagree in the number and commencement of them.

USE, in law, the profit or benefit of lands and tenements; or a truſt and confidence repoſed in a perſon for the holding of lands, &c. that he to whoſe uſe the truſt is made ſhall receive the profits.

Uſes may be limited to a perſon and the wife he ſhall marry; and if the parties to a deed agree, and declare, that one of them ſhall make a feoffment, or levy a fine, to the uſe and intent that he ſhall hold the lands for his life, and after his deceaſe another in tail, and afterwards a third in fee ſimple, &c. the eſtate ſettles according to the uſes in the deed.

The conveyances to uſes are ſaid to be of three ſorts, viz. a covenant to ſtand ſeized; a feoffment, fine or recovery to uſes; and a bargain and ſale; which laſt a contingent uſe cannot be ſupported by, though it may by the two firſt.

A ſuperſtitious uſe, is where lands or goods are deviſed to a prieſt to pray for the ſouls of the dead, &c. in which caſe they become forfeited to the king: and where ſuch an uſe is void, and the king cannot have the land, it ſhall not reſult to the heir at law; but it may be applied to charity.

USES *and Cuſtoms of the Sea*, are certain maxims or rules which form the baſis of maritime juriſprudence, by which the policy of navigation and the commerce of the ſea are regulated.

The uſes and cuſtoms conſiſt of three kinds of regulations: the firſt called the laws or judgments of Oleron; the ſecond, regulations made by the merchants of Wiſbuy, a city in the iſland of Gothland, in the Baltic, anciently much famed for commerce; and the third, a ſet of regulations made at Lubec, by the deputies of the Hanſe towns.

USHER, an officer, or ſervant, who has the care and direction of the door of a court, hall, chamber, or the like.

In the king's houſhold there are two gentlemen uſhers of the privy-chamber, appointed to attend the door, and give entrance to perſons that have admittance thither; four gentlemen-uſhers, waiters; and eight gentlemen-uſhers, quarter-waiters in ordinary.

USHER, alſo ſignifies an officer of the court of Exchequer, of which there are four who attend the barons and chief officers of that court at Weſtminſter, as alſo juries, ſheriffs, &c. at the pleaſure of the court. There is alſo an uſher of the court of Chancery.

USHER *of the Black-Rod*, the eldeſt of the gentlemen-uſhers, daily waiters at court, whoſe duty is to bear the rod before the king at the feaſt of St. George, and other ſolemnities; he has alſo the keeping of the chapter-houſe door, when a chapter of the order of the garter is ſitting; and, in time of parliament, attends the houſe of peers, and takes delinquents into cuſtody. He wears a gold badge, embelliſhed with the enſigns of the order of the garter.

USNEA, in botany, a genus of moſſes, wholly deſtitute of leaves, and compoſed only of long ſlender filaments, or ſtalks, which are uſually ſolid, rigid, and of a cylindric figure. The whole plants are fixed in the manner of miſletoe to the barks of trees.

USQUEBAUGH, a ſtrong compound liquor, chiefly taken by way of dram.

There are ſeveral different methods of making this liquor; but the following is eſteemed one of the beſt: To two gallons of brandy, or other ſpirits, put a pound of Spaniſh-liquorice, half a pound of raiſins of the ſun, four ounces of currants, and three of ſliced dates; the

tops of baum, mint, ſavory, thyme, and the tops or the flowers of roſemary, of each two ounces; cinnamon and mace; well bruiſed, nutmegs, anniſeeds, and coriander-ſeeds, bruiſed likewiſe, of each four ounces; of citron, or lemon and orange-peel, ſcraped, of each an ounce; let all theſe infuſe forty-eight hours in a warm place, often ſhaking them together: then let them ſtand in a cool place for a week: after which the clear liquor is to be decanted off, and to it is to be put an equal quantity of neat white port, and a gallon of canary; after which it is to be ſweetened with a ſufficient quantity of double-refined ſugar.

USTION, in pharmacy, the preparing of certain ſubſtances by burning them.

USTULATION, *Uſtulatio*, a word uſed by pharmaceutic writers to expreſs the roaſting or torrefying of humid or moiſt ſubſtances over a gentle fire, ſo as to render them fit for powdering. The ſame word is alſo uſed by ſome for what we call burning of wine.

USUCAPTION, *Uſucaptio*, in the civil law, is an acquiſition of the property of a thing, by a poſſeſſion and enjoyment thereof for a certain term of years preſcribed by law.

USUFRUIT, *Uſus Fructus*, in the civil law, the uſe or enjoyment of any lands or tenements; or the right of receiving the fruits and profits of an inheritance, or other thing, without a power of alienating or changing the property thereof.

USURER, a perſon charged with a habit or act of uſury. See the article USURY.

USURIOUS CONTRACT, is any bargain or contract, whereby a man is obliged to pay more intereſt for money than the ſtatute allows.

USURPATION, in law, is an injurious uſing or enjoyment of a thing for continuance of time, that belongs of right to another.

USURY, *Uſura*, in the general, denotes a gain or profit, which a perſon makes of his money, by lending the ſame; or it is an increaſe of the principal, exacted for the loan thereof; or the price a borrower gives for the uſe of a ſum credited to him by the lender, called alſo intereſt; and in ſome ancient ſtatutes, dry-exchange.

The word uſury is generally taken in an evil ſenſe, viz. for an unlawful profit which a perſon makes of his money; in which ſenſe it is, that uſury is forbidden by the civil and eccleſiaſtical, and even by the law of nature.

By ſtat. 12 Ann. c. 16. which is called, The Statute againſt exceſſive Uſury, it is ordained, that no perſon ſhall take for the loan of any money, or other thing, above the value of five pounds for the forbearance of one hundred pounds for a year; and ſo in proportion for a greater or leſſer ſum: and it is declared, that all bonds, contracts, and aſſurances, made for payment of any principal ſum to be lent on uſury, above that rate, ſhall be void; and that whoſoever ſhall take, accept, or receive, by way of corrupt bargain, loan, &c. a greater intereſt than that laſt above-mentioned, ſhall forfeit treble the value of the money lent; and alſo, that ſcriveners, ſolicitors, and drivers of bargains, ſhall not take or receive above five ſhillings for the procuring the loan of one hundred pounds for one year, on pain of forfeiting twenty pounds, &c.

There can be no uſury without a loan, between which and a bargain the court has diſtinguiſhed: and though a perſon is to pay double the ſum borrowed, &c. by way of penalty, for the non-payment of the principal debt, it is not uſury; ſo it alſo is in reſpect to the grant of an annuity for lives, or on condition, where it exceeds the uſual intereſt, and the proportion attending contracts of this kind. Even if one ſecures a large intereſt and principal, and it is at the will of the party who is to pay; or where it happens that both the principal money and extraordinary intereſt are in hazard, or that a perſon may have leſs than his principal; as when a bond is made to pay money upon the return of a ſhip from ſea, &c. either of theſe caſes are not held to be uſury.

In an action brought for uſury, the ſtatute made againſt it muſt be pleaded; and in pleading an uſurious contract, as a bar to an action, the whole matter is to be ſet forth ſpecially, becauſe it lies within the parties own privity; yet on an information on the ſtatute for making ſuch contract, it is ſufficient to mention the corrupt bargain generally; becauſe matters of this kind are ſuppoſed to be privily tranſacted; and ſuch information may be brought by a ſtranger. 1 *Hawk. P. C.* 248.

Likewiſe upon an information on the ſtatute againſt uſury, he that borrows the money may be a witneſs, after he has paid the ſame.

UT, a Latin term, literally ſignifying *as*, much uſed in ſtating of ratios and proportions.

UT, in muſic, the firſt of the muſical notes, which, with the reſt, was taken out of the hymn of St. John Baptiſt, *Ut queant laxis*, &c. See the articles SCALE, MUSIC, &c.

UTENSIL, *Utenſile*, a little domeſtic moveable, belonging principally to a kitchen: ſuch are pots, pans, &c.

Utenſils are more particularly uſed in war, for the moveables which the hoſt is obliged to furniſh the ſoldiers quartered with him; which are, a bed with bed clothes, a pot, and a ſpoon.

UTERINE, *Uterinus*, ſomething belonging to the uterus, or womb of a woman.

Furor UTERINUS, in medicine, denotes a kind of madneſs, attended by laſcivious ſpeeches and geſtures, and an invincible inclination to venery. See FUROR.

UTERUS, the womb, in anatomy, a hollow body, called alſo the matrix, of a form approaching to that of a pear, ſituated between the bladder and the rectum, and deſtined to the office of generation, for the containing the fœtus. It is connected in the anterior part with the vagina, and at its lateral part by the ligaments, lata and rotunda, being looſe in its hinder part.

In women not with child, the length of the uterus is about three inches; its breadth, in the upper part, being about two inches, and in the lower part one. Its thickneſs is about an inch and an half: in virgins, indeed, it is much ſmaller than this; but in women with child it is of a different ſize, according to the different time of geſtation.

Anatomiſts divide it into two parts; the upper and broader part they call the fundus uteri, and the lower they call the cervix, into which it is that the vagina opens. See VAGINA.

The orifice, or, as it is otherwiſe called, the internal mouth of the womb, opens into the vagina, in form of the glans penis in men: it is very ſmall in virgins, but in women who have had children, or who are with child, it is larger; and in the laſt it is always cloſed up with a glutinous humour: in the time of delivery, it in a wonderful manner expands itſelf, ſo as to give paſſage to the child. See DELIVERY.

The ſubſtance of the womb is muſculous, being compoſed of a various plexus of fleſhy fibres with a great number of veſſels between. In women not with child, it is compact and firm; in thoſe with child, it is ſpongy and ſinuous, and is capable of wonderful dilatation, without any diminution of its thickneſs. It is covered externally with a membrane from the peritonæum, and internally, its cavity is lined with a porous and nervous membrane: this cavity is very ſmall in virgins; and in women with child, the inner membrane almoſt entirely diſappears.

The blood-veſſels of the uterus are tortuous, and make a thouſand anaſtomoſes with one another: they open by a number of little mouths into the uterus and vagina, and are the ſources of the menſtrual diſcharge in women. See MENSES.

The arteries are of three kinds, viz. ſpermatics from the aorta; very large ones from the hypogaſtrics; and others from the hæmorrhoidal arteries. The veins of the uterus are alſo of three kinds, and of the ſame denominations: they have valves, and are greatly larger than the arteries, eſpecially in women with child. The nerves of the womb are from the intercoſtals, and thoſe of

of the os ſacrum. The lymphatics have long ſince been diſcovered in brutes; but Morgagni has of late years found them alſo in human ſubjects.

UTILE, a Latin term, ſignifying profitable or uſeful; in which ſenſe it is ſometimes uſed by Engliſh writers.

UVEA, in anatomy, the third or outermoſt coat of the eye. See EYE.

VULCANO, or VOLCANO, in natural hiſtory, a burning mountain, or one that vomits forth fire, flame, aſhes, cinders, &c. See the article MOUNTAIN.

As to the cauſe of vulcanos, it is found by experience, that there are ſeveral inflammable bodies, which, being mixed together in due proportion, will kindle into flame by fermentation alone, without the help of any fiery particles. Thus M. Lemery having covered up in the earth about fifty pounds of a mixture, compoſed of equal parts of ſulphur and filings of iron, tempered with water; after eight or nine hours time, the earth, where it lay, vomited up flames. From this experiment we ſee the true cauſe of the fire of Ætna, Veſuvius, and other burning mountains, which probably are made up of ſulphur and ſome other matter proper to ferment with it, and take fire.

VULGATE, a very ancient Latin tranſlation of the Bible, and the only one the church of Rome acknowledges to be authentic.

The vulgate of the Old Teſtament was tranſlated, almoſt word for word, from the Greek of the Septuagint: the author of it is not known, or ſo much as gueſſed at. It was a long time known by the name of the Italic Verſion, as being of great antiquity in the Latin church. It was commonly in uſe, before St. Jerom made a new one from the Hebrew. St. Auſtin preferred this vulgate before all the other Latin verſions, as rendering the words and ſenſe of the ſacred text more cloſely and juſtly than any of the reſt. It has been ſince corrected from the emendations of St. Jerom; and it is this mixture of the ancient Italic verſion with the corrections of St. Jerom, that is now called the vulgate, and which the council of Trent has declared to be authentic.

The vulgate of the New Teſtament is, by the Romaniſts, generally preferred to the common Greek text. The prieſts read no other at the altar; the preachers quote no other in the pulpit, nor the divines in the ſchools. F. Bouhours ſpent the laſt years of his life in giving a French tranſlation of the New Teſtament from the vulgate. Yet that judicious critic owns, that, in ſome few paſſages, the Greek appears more clear and intelligible than the Latin. The editors of the Oxford Greek Teſtament, 1675, declare, there is no verſion in any language to be compared with the vulgate. See the article BIBLE.

VULNERARY, in medicine, an epithet given to remedies proper for the cure of wounds and ulcers.

All medicines of this intention are ſuppoſed both to cleanſe and heal; that is, incarnate, or fill up with new fleſh, all ulcerations and foulneſſes. Under this head are ranged all ſuch balſamics as are not only ſoftening and adheſive, but alſo, by a peculiar activity, joined with a ſuitable configuration of parts, are apt to abrade and carry along with them what particles they hold on in their paſſage.

VULPES, the fox. See the article FOX.

VULTURE, a genus of birds, with four toes on each foot, three of which are placed forwards; the neck is long, and almoſt bare of feathers; the legs are covered with feathers down to the feet, or nearly ſo; and under the throat there is a ſpace covered with hairs inſtead of feathers; the head alſo in many ſpecies, is naked, and has at the moſt only a downy matter on it, inſtead of feathers; and the under part of the wings is downy.

VULVA, in anatomy, a name given as well to the uterus, or womb, as to the cunnus or pudendum muliebre. See UTERUS and PUDENDUM.

UVULA, in anatomy, a round, ſoft, ſpongeous body, like the end of a child's finger, ſuſpended from the palate, near the foramina of the noſtrils, perpendicularly over the glottis. Its uſe is to break the force of the cold air, and prevent its entering too precipitately into the lungs. It is formed of a duplicature of a membrane of the palate; and is called, by ſome authors, columella, and by others gurgulio.

It is moved by two pair of muſcles, and ſuſpended by as many ligaments.

UVULARIA, in botany, a genus of plants, whoſe flower conſiſts of ſix oblong, erect, lanceolated petals, with an oblong nectarium cut into the baſe of each petal; the ſtamina are ſix very ſhort filaments, topped with long erect antheræ; the fruit is an ovato-oblong trilocular capſule, containing many roundiſh compreſſed ſeeds.

UXOR, among chemiſts, ſignifies the mercury of metals. See MERCURY and METAL.

UXORIUM, in antiquity, a fine or forfeit paid by the Romans, for not marrying.

UZIFIR, UZUFAR, or UZIFUR, in chemiſtry, a name which ſome authors give to cinnabar. See CINNABAR.

W.

WAG

W, The twenty-firſt letter of our alphabet, and compoſed, as its name implies, of two V's. It was not in uſe among the Hebrews, Greeks, or Romans, but chiefly peculiar to the northern nations, the Teutones, Saxons, Britons, &c. but ſtill it is not uſed by the French, Italians, Spaniards, or Portugueſe, except in proper names, and other terms borrowed from languages in which it is originally uſed, and even then it is ſounded like the ſingle V.

This letter is of an ambiguous nature, being a conſonant at the beginning of words, and a vowel at the end. It may ſtand before all the vowels except *u*, as *water*, *wedge*, *winter*, *wonder*. It may alſo follow the vowels *a*, *e*, *o*, and unites with them into a kind of double vowel, or diphthong, as in *ſaw*, *few*, *cow*, &c. It alſo goes before *r*, and follows *s*, and *th*, as in *wrath*, *ſwear*, *thwart:* it goes before *h* alſo, though in reality it is ſounded after it, as in *when*, *what*, &c. In ſome words it is obſcure, as in *ſhadow*, *widow*, &c.

WADD, or WADDING, is a ſtopple of paper, hay, ſtraw, or the like, forced into a gun upon the powder, to keep it cloſe in the chamber; or to put up cloſe to the ſhot, to keep it from rolling out.

WAFT. To waft a ſhip, is to convoy her ſafe, as men of war do merchant-ſhips. To make a waft, is to hang out ſome coat, ſea-gown, or the like, on the main ſhrouds of the ſhip, as a ſignal for people to come aboard, and ſignifying that the ſhip is in great diſtreſs.

WAFERS, or SEALING WAFERS, are made thus: Take very fine flour, mix it with glair of eggs, iſinglaſs, and a little yeaſt; mingle the materials; beat them well together, ſpread the batter, being made thin with gum-water, on even tin plates, and dry them in a ſtove; then cut them out for uſe.

You may make them of what colour you pleaſe, by tinging the paſte with Brazil or vermilion for red; indigo or verditer, &c. for blue; ſaffron, turmerics, or gambooge, &c. for yellow.

WAGE, in law, denotes the giving ſecurity for the performance of any thing.

WAGER *of Law*, is uſed where an action of debt is brought againſt a perſon, upon a ſimple contract between the parties, without deed or record, and the defendant, in preſence of his compurgators, ſwears in court, that he owes the plaintiff nothing in form and manner as he has declared: and here the reaſon of waging of law is, becauſe the defendant may have paid to the plaintiff his debt in private, or before witneſſes who may be all dead, and therefore the law allows him to wage his law in diſcharge; and in that caſe his oath ſhall be accepted to diſcharge himſelf, rather than the law will ſuffer him to be charged upon the bare allegation of the plaintiff. The method of waging law is this, viz. the defendant generally brings ſix compurgators with him into court, and ſtands at the end of the bar towards the right hand of the chief juſtice; the ſecondary aſks him whether he will wage his law? whereto if he anſwers that he will, the judges admoniſh him to be well adviſed, telling him the danger of taking a falſe oath; and if he ſtill perſiſts, then the ſecondary ſays, and the defendant, who wages his law, repeats after him, "Hear this, ye juſtices, that I C. D. do not owe to A. B. the ſum of ————, nor any penny thereof, in manner and form as the ſaid A. B. has declared againſt me: ſo help me God." After the defendant has thus ſworn, and the compurgators given in, upon oath, that they believe he ſwears true, the plaintiff is for ever barred; it being as much as if a verdict had paſſed againſt him.

WAGGON, a vehicle or carriage, of which there are various forms, accommodated to the different uſes they are intended for.

The common waggon conſiſts of the ſhafts or rads, being the two pieces which the hind horſe bears up; the welds; the ſlotes, or croſs-pieces which hold the ſhafts together; the bolſter, being that part on which the fore-wheels and the axle-tree turn, in wheeling the waggon acroſs the road; the cheſt, or body of the waggon, having the ſtaves or rails fixed thereon; the bales, or hoops, which compoſe the top; the tilt, the place covered with cloth, at the end of the waggon. For the principles on which this carriage is conſtructed, ſee the article WHEEL.

WAGGON-*Maſter-general*, in the military art, is he who has the ordering and marching of the baggage of the army. On a day of march he meets the baggage at the place appointed in the orders, and marſhals it according to the rank of the brigade or regiment each waggon belongs to, which is ſometimes in one column, ſometimes in two; ſometimes after the artillery; and ſometimes the baggage of each column follows their reſpective column.

WAGTAIL, in ornithology, the name of two different ſpecies of motacilla.

The white or common wagtail is the motacilla with a black breaſt. This is a very beautiful bird, much about the ſize of the goldfinch, but the body is longer in proportion, and much better covered with feathers; the head is large and rounded; the eyes are large, and their iris hazel; the beak is ſtrait, ſlender, moderately long and black; the beak and the eyes are ſurrounded with a ſpace of white, which is continued in a broad line down almoſt to the wings; the crown of the head, both ſides of the neck, and back are black, the breaſt and belly are white; the tail is long, and both that and the wings are variegated with black and white.

The other ſpecies is the yellow wagtail, or the yellow breaſted motacilla, much reſembling the former, only

only that the breaſt and belly are yellow; the ſides of the head variegated with ſome ſtrokes of yellow, and the wings with white.

WAIF, or WAFE, in law, a term applied to ſuch goods as a thief having feloniouſly ſtolen, on his being cloſely purſued, are waifed or left by the felon, which become forfeited to the king, or lord of the manor: and ſo it alſo is where a felon has the goods in his cuſtody, and apprehending that purſuit is made, he flies, and leaves them behind him.

Though waif is properly applied to goods that are ſtolen, yet it may be alſo ſaid of goods not ſtolen or taken away, as where a perſon is purſued with hue-and-cry as a felon, and he flies and leaves his own goods; in this caſe theſe ſhall be forfeited as ſtolen goods, or what are uſually called fugitives goods.

WAIF, is alſo applied to things loſt, and eſtrays, which, no owner appearing, are forfeited to the lord of the manor, after they have been cried and publiſhed in the markets.

WAINSCOT, in building, the timber-work that ſerves to line the walls of a room, being uſually made in pannels, and painted, to ſerve inſtead of hangings.

It is uſual, even in halls, to have wainſcot breaſt high, by reaſon of the natural moiſtneſs of the walls. Some joiners put charcoal behind the pannels, to prevent the ſweat of the ſtone and brick walls from ungluing the joints; others uſe wool for the ſame purpoſe; but the only ſure way is to prime over the back-ſides of the joints with white-lead, Spaniſh brown, or linſeed-oil.

The wainſcotting with Norway oak, according to Neve, the workman finding ſtuff, is valued at 6 s. or 7 s. per yard ſquare; plain ſquare wainſcotting, the workman finding deal, is valued at 3 s. and 3 s. and 6 d. per yard. Ordinary biſſection wainſcotting, the workman finding deal, is worth 3 s. and 6 d. and 4 s. per yard. Large biſſection wainſcotting with Dantzic ſtuff, is valued at 6 s. or 7 s. per yard.

WAIVE, according to the different acceptations of the word, ſignifies to forſake, but in the law it is eſpecially applied to a woman, who, for any crime, for which a man may be outlawed, is termed waive.

WAIVER, in law, denotes the paſſing by a thing, or a refuſal to accept thereof; and relates ſometimes to an eſtate conveyed to a perſon, and ſometimes to a plea.

It is held, where a particular eſtate is granted with a remainder over; in that caſe, he that has it, may not regularly waive it to the damage of him in remainder; tho' where one has the reverſion, it is otherwiſe, for that is not hurt by ſuch waiver.

WAKE *of a Ship*, is the ſmooth water aſtern when ſhe is under ſail: this ſhews the way ſhe has gone in the ſea, whereby the mariners judge what way ſhe makes.

If the wake be right aſtern, they conclude ſhe makes her way forwards; but if the wake be to leeward a point or two, then they conclude ſhe falls to the leeward of her courſe. When one ſhip, giving chaſe to another, is got as far into the wind as ſhe can, and ſails directly after her, they ſay, ſhe has got into her wake.

A ſhip is ſaid to ſtay to the weather of her wake, when in her ſtaying, ſhe is ſo quick, that ſhe does not fall to leeward upon a tack, but that when ſhe is tacked, her wake is to the leeward; and it is a ſign ſhe feels her helm very well, and is quick of ſteerage.

WAKE, is the eve feaſt of the dedication of churches, which is kept with feaſting and rural diverſions.

WALE, or WALES, in a ſhip, thoſe outermoſt timbers in a ſhip's ſide, on which the ſailors ſet their feet in climbing up.

They are reckoned from the water, and are called her firſt, ſecond, and third wale, or bend. See SHIP.

WALE-KNOT, a round knot, or knob, made with three ſtrands of a rope, ſo that it cannot ſlip, by which the tacks, top-ſail ſheets, and ſtoppers, are made faſt, as alſo ſome other ropes.

WALE REARED, on board a ſhip, a name the ſeamen give to a ſhip, which, after ſhe comes to her bearing, is built ſtraight up: this way of building, though it does not look well, nor is, as the ſeamen term it, ſhip-ſhaped, yet it has this advantage, that a ſhip is thereby more roomy within board, and becomes thereby a wholeſome ſhip at ſea, eſpecially if her bearing be well laid out.

WALES, a principality in the weſt of England, comprehending twelve counties, bounded by Cheſhire, Shropſhire, Herefordſhire, and Monmouthſhire, on the eaſt, and ſurrounded by the ſea called the Iriſh Channel on the north, weſt, and ſouth.

WALK, in gardening, an ornamental and uſeful part of a garden, differing from an alley by being wider.

Walks are either ſtraight or ſerpentine; the materials of which they are formed are gravel, ſand, or graſs; but where ſand or gravel cannot be procured, they are ſometimes laid with powdered coal, ſea-coal aſhes, and ſometimes with powdered brick, but none equals thoſe made with gravel, and in order to the laying thoſe kind of walks, it is very proper to fill the bottom with lime, rubbiſh, flint ſtones, coarſe gravel or other rocky materials, which will be of ſervice to prevent weeds from growing through the gravel, and to hinder worm-caſts; this bottom ſhould be ten inches or a foot thick, over which a coat of fine gravel, mixed with a due proportion of loam, ſhould be laid, to the thickneſs of ten inches. The common allowance for a gravel walk of five feet breadth is an inch in the crown, ſo that if a walk be twenty feet wide, it ſhould be four inches higher in the middle than on each ſide.

When a walk has been evenly laid, trodden down, and raked, it ſhould then be rolled well both in length and width; and in order to make them more firm, it will be neceſſary to give them three or four water-rollings, that is, they ſhould be rolled when it rains very faſt: this will cauſe the gravel to bind, ſo that when the walks come to be dry, they will be as hard as terrace.

Gravel walks are not only very neceſſary near the houſe, but there ſhould always be one carried quite round the garden, becauſe being ſoon dry after rain, they are proper for walking on in all the ſeaſons; but then theſe ſhould be but few, and thoſe adjoining to the houſe ought to be large in proportion to the ſize of the houſe and garden: the principal of theſe walks ſhould be elevated, and carried parallel with the houſe, ſo as to form a terrace; this ſhould extend itſelf each way in proportion to the width of the garden, ſo that from this there may be a communication with the ſide walks, whereby there may be dry walking all round the garden.

Sand walks are alſo frequently made in gardens; theſe are leſs expenſive in the making, and alſo in keeping in order than thoſe of gravel; for as the greateſt part of the walks which are made in modern gardens twiſt about in an irregular ſerpentine manner, it would be very difficult to keep them handſome if they were laid with gravel, eſpecially where they are ſhaded by trees; for the dripping of the water from their branches in hard rains, is apt to waſh the gravel in holes, and render the walks very unſightly; therefore thoſe walks which go through woods and plantations are much better if laid with ſand, which will be dry and wholeſome, and whenever they appear moſſy, or any weeds begin to grow on them, if they are ſcuffled over with a Dutch hoe in dry weather, and raked ſmooth, it will deſtroy the moſs and weeds, and make the walks appear as freſh and handſome as when firſt laid.

The breadth of theſe walks ſhould be proportioned to the ſize of the ground, which, in a large extent, may be twelve or fourteen feet wide, but in ſmall gardens five or ſix will be ſufficient.

The ground being traced out in the manner as the walks are deſigned, the earth ſhould be taken out of the walk, and laid in the quarters; the depth of this muſt be proportioned to the nature of the ſoil, for where the ground is dry, the walks need not be elevated above the quarters, ſo the earth may be taken out four or five inches deep in ſuch places; but where the ground is wet, the bottom of the walks need not be more than two inches below the ſurface, that the walks may riſe ſo high

as to throw off the wet into the quarters, which will render them more dry and healthy to walk on: after the earth is taken out, the bottom of the walks ſhould be laid with rubbiſh, coarſe gravel, &c. to the thickneſs of five or ſix inches, and beaten down cloſe, to prevent the worms from working through it; then the ſand ſhould be laid upon this about three inches thick, and after treading it down, it ſhould be raked over to level and ſmooth the ſurface: the ſand that is fitting for this purpoſe ſhould be ſuch as will bind, otherwiſe it will be very troubleſome to walk on them in dry weather; for if the ſand be of a looſe nature, it will be moved by ſtrong gales of wind, and in dry weather will ſlide from under the feet; and if it is too much inclinable to loam, it will alſo be attended with as ill conſequence as that which is too looſe, for this will ſtick to the feet after every rain; ſo that where ſand can be obtained of a middle nature, it ſhould always be preferred.

Graſs walks in gardens were formerly held in great eſteem, and were looked upon as neceſſary ornaments to a garden; but of late years they have been much leſs regarded; for theſe long narrow ſlips of graſs are far from being pleaſing to the eye, and are for the greateſt part of the year uſeleſs, being generally too damp for perſons of tender conſtitutions to walk on; and whenever they were conſtantly uſed, they became bare in the places frequently trodden, ſo were rendered more unſightly; and as the intention of walks in gardens is to have at all ſeaſons a dry communication through them for exerciſe and recreation, graſs walks were very improper, becauſe every ſhower of rain made them ſo wet, as not to be fit for uſe for a conſiderable time; and the dews rendered them damp to walk on either in the morning or evening, and if they are not kept conſtantly cloſe mowed, then they become not only unhealthful but troubleſome to the feet; beſides, whenever the ground is ſo dry, as that perſons may with ſafety walk upon graſs, the lawns and other parts of verdure in gardens are better adapted for uſe than any of theſe formal ſtiff walks, which were ſo much eſteemed in the laſt age.

Walk, in the manege, is the ſloweſt, and leaſt raiſed of all a horſe's goings. It is performed by the horſe's lifting up his two legs on a ſide, the one after the other, beginning with the hind leg firſt. Thus, if he leads with the legs of the right ſide, then the firſt foot he lifts is the far hind-foot, and in the time he is ſetting it down, which in a ſtep is always ſhort of the tread of his fore-foot on the ſame ſide, he lifts his far fore-foot, and ſets it down before his near fore-foot. Again, juſt as he is ſetting down his far fore-foot, he lifts up his near hind-foot, and ſets it down again juſt ſhort of his near fore-foot; and juſt as he is ſetting it down he lifts his near fore-foot, and ſets it down beyond his far fore foot.

WALL, in architecture, the principal part of a building, as ſerving both to incloſe it, and ſupport the roof, floors, &c. See Building.

Walls are diſtinguiſhed into various kinds, from the matter of which they conſiſt, as plaſtered or mud walls, brick-walls, ſtone-walls, flint, or boulder walls, and boarded walls. In all which theſe general rules are to be regarded. 1. That the right angle therein depending is the true cauſe of all ſtability, both in artificial and natural poſition. 2. That the maſſieſt and heavieſt materials be the loweſt, as fitter to bear than to be borne. 3. That the walls, as they riſe, diminiſh proportionably in thickneſs, for eaſe both of weight and expence. 4. That certain courſes or ledges, of more ſtrength than the reſt, be interlaid, like bones to ſtrengthen the whole fabric. See House.

Brick-walls are the moſt important and uſual amongſt us. In theſe, particular care is to be taken about laying of the bricks; that in ſummer they be laid as wet, and in winter as dry, as poſſible, to make them bind the better with the mortar: that in ſummer, as faſt as they are laid, they be covered up, to prevent the mortar, &c. from drying too faſt: that in winter they be covered well to protect them from rain, ſnow, and froſt, which are all enemies to mortar: that they be laid joint on joint in the middle of the walls as ſeldom as may be: but that good bond be made there as well as on the outſide. Care is to be taken that the angles be firmly bound, which are the nerves of the whole edifice. In order to which, in working up the walls of a building, it is not adviſeable to raiſe any wall above eight feet high, before the next adjoining wall be wrought up to it, that ſo good bond may be made in the progreſs of the work: it may be worth notice, that a wall a brick and a half thick, with the joint, will be in thickneſs fourteen inches, or very near; whence 150 or 160 bricks will lay a yard ſquare meaſured upon the face of the building; and to the ſquare of ten feet are uſually allowed 1700 or 1800 bricks.

Flint, or boulder walls are much uſed in ſome parts of Suſſex and Kent, for fence-walls, round courts, gardens, &c. A right and left-handed man fits well for this work, as they have a hod of mortar poured down upon the work, which they part between them, each ſpreading it towards himſelf, and ſo they lay in the flints. The mortar for this work muſt be very ſtiff.

Wall, in gardening.—Of all materials for building walls for fruit-trees, brick is the beſt; it being not only the handſomeſt, but the warmeſt and kindeſt for the ripening of fruit; and affording the beſt conveniency for nailing, as ſmaller nails will ſerve in brick than will in ſtone walls, where the joints are larger; and if the walls are coped with free-ſtone, and ſtone pilaſters or columns at proper diſtances, to ſeparate the trees, and break off the force of the winds, they are very beautiful, and the moſt profitable walls of any others.

In ſome parts of England there are walls built both of brick and ſtone, which are found very commodious. The bricks of ſome places are not of themſelves ſubſtantial enough for walls; and therefore ſome perſons, that they might have walls both ſubſtantial and wholeſome, have built theſe double, the outſide being of ſtone, and the inſide of brick: but there muſt be great care taken to bind the bricks well in the ſtone, otherwiſe they are very apt to ſeparate one from the other, eſpecially when froſt comes after much wet.

There have been ſeveral trials made of walls built in different forms; ſome of them having been built ſemicircular; others in angles of various ſizes; and projecting more towards the north, to ſcreen off the cold winds: but there has not as yet been any method which has ſucdeeded near ſo well as that of making the walls ſtraight and building them upright. Where perſons are willing to be at the expence, in the building of their walls ſubſtantial, they will find it anſwer much better than thoſe which are ſlightly built, not only in duration, but in warmth: therefore a wall two bricks thick, will be found to anſwer better than one of a brick and a half: and if in building of garden-walls they are grouted with ſoft mortar, to fill and cloſe all the joints, the walls will be much ſtronger, and the air will not ſo eaſily penetrate, as it does through thoſe which are commonly built.

If the walls are built on arches, and the trees planted at thoſe arched places, the trees will be thereby enabled to extend their roots underneath the wall, and be greatly benefited, and forwarded in their growth.

It has been hitherto an almoſt unvaried practice, to plant all the finer fruits againſt walls, without ſufficiently inquiring into the motives for ſo doing. But it ſhould be obſerved in the firſt place, that the borders under the walls are ſeldom made ſo wide as they ought to be, conſidering that the trees which are planted there can extend their roots but one way: and ſecondly, that due care is not taken to adapt the quality of the ſoil there to the nature of the trees; a precaution which ought to be attended to by thoſe who are curious in their fruit, and which would coſt only the trifling expence of bringing in a ſufficient depth of proper earth.

The chief reaſon aſſigned for planting trees againſt walls is, the additional heat procured by the reflected rays of the ſun, and the warmth communicated to the wall itſelf by the ſun. This, ſay the advocates for this practice, haſtens the ripening of the fruit, and exalts its flavour; beſides, that the ſhelter of the walls protects trees, natives of warmer climates, from our ſevere north and north-eaſt winds.

To this it may be anſwered, that it is a conſtant obſervation, that all plants brought from a warmer climate to a colder, endeavour to bloom at their uſual ſeaſon, unleſs they are prevented by cold. The conſequence of this is, that if the early part of the ſpring happens to be warm, the bloſſoms of ſuch trees ſwell, and expand themſelves: but as we cannot be exempted from froſt ſo ſoon in the ſeaſon, theſe bloſſoms are nipped in the bud; that is, the firſt froſty night ſtops the circulation in them, and they then neceſſarily die. Nothing ſhews more inconteſtibly the ſtoppages of the circulation in trees, than tapping, for inſtance, a birch tree, early in the ſpring: for the warmth, or coldneſs, of the air at that time may be determined by the greater or leſs velocity with which the juice flows, or by the greater or leſs quantity of it, that is diſcharged, almoſt as certainly as by a thermometer. In froſt, the diſcharge ceaſes entirely. It therefore is not at all wonderful, that the circulation is interrupted, by the ſame cauſe, in the finer veſſels of flowers, and that the death of the flower is the neceſſary conſequence. A very ſharp froſt, even after the early fruits are ſet, has the ſame effect on their yet tender veſſels; and the owner is ſurpriſed to find his fruit fall off, in a few days after, without any ſeeming cauſe; unleſs recourſe be had to I know not what peſtilential quality in the eaſt wind, when the ſame effect would follow, did the froſt come from any other quarter. Hence it is evident, that fruit trees would be benefited, rather than hurt, by preventing their too early bloſſoming.

Some gentlemen endeavour to guard againſt this accident, by ſheltering their trees with ſkreens, which have a double effect; that of preſerving them from the warmth of the ſun by day, and that of defending them from the froſt by night. But if theſe trees were planted as ſtandards, where the air might play freely round them, the motion of the ſap would be leſs forward, and the bloſſoms would conſequently be leſs expoſed to the injuries which happen from their coming out too early. They would likewiſe eſcape another great inconvenience which attends their ſtanding againſt walls; namely, the too great inequality of the heat, as increaſed by the wall, and the coldneſs of the night, againſt which the wall affords no ſhelter, otherwiſe than as it ſkreens the trees from the wind.

A farther reaſon which renders walls the leſs neceſſary is, that the fruits planted againſt them ripen before the ſun has acquired its full force in this climate. This is what happens to all our apricots, to moſt of our nectarines, and to the fineſt of our peaches: for it is well known, that the month of July is our hotteſt ſeaſon, and that the heat of that month will therefore the moſt perfectly exalt the juices and flavour of fruit.

Walls may indeed be neceſſary for the later peaches; though even a Catherine peach will ripen on a ſtandard, in a favourable ſituation.

All the ſtone fruits are accounted peculiarly proper for walls, and ſo are many kinds of pears. Some of the finer ſorts of theſe laſt may indeed do well enough when ſo planted: but I cannot by any means think the cherry, for example, a proper tree for a wall, becauſe it will not bear the cutting neceſſary to train it in that manner. The late pears and peaches are, in my opinion, the only fruits really fit for this ſort of culture. However, for the ſake of thoſe who chuſe to continue to extend it to other kinds, we ſhall obſerve, that peach trees, and thoſe of nectarines, placed againſt walls, ſhould be ſet about twelve feet aſunder: apricots ſhould be allowed a breadth of ſixteen or eighteen feet; cherries and plums, twenty-five feet; and moſt ſorts of vigorous ſhooting pears, from thirty to forty, according to the goodneſs of the ſoil, and the height of the wall.

The root of the tree taken from the nurſery ſhould be placed in a hole dug about five inches from the wall, and its head ſhould be inclined thereto, with the bud turned outwards, to conceal the wounded part of the ſtock. The hole ſhould then be filled up, ſo as neither to leave chaſms between the roots, nor to preſs the earth down too hard upon them. Some of the twigs of the young tree ſhould then be faſtened to the wall, to prevent the wind's diſplacing it ſo as to break the tender fibres of its roots; the ſurface of the ground ſhould be covered with muſch, to keep out the froſt; and in the following ſpring, about the beginning or middle of March, according as the ſeaſon is earlier or later, the head of the tree ſhould be cut down to four or five eyes above the bud, juſt before it begins to ſhoot. In this cutting off the head, the gardener, to avoid as much as poſſible giving any diſturbance to the roots, ſhould ſet his foot down cloſe to the ſtem of the tree, and take faſt hold of the ſtock, below the bud, with one hand, to keep it ſteady, whilſt, with the other, he ſlopes off the upper part gently, with a ſharp knife, at the intended place, which ſhould always be juſt above an eye. This ſhould be done in dry weather; for if much rain ſhould fall ſoon after, and wet get into the wounded part, the tree will be liable to ſuffer conſiderable damage: and for the ſame reaſon, together with its preventing the cloſing of the wound, froſty weather ſhould alſo be cautiouſly avoided. After the tree has been headed, the earth of the borders ſhould be looſened gently, to render it more fit to admit the fibres of the roots, and if the mulch which was laid on in the autumn be rotten, it may be dug into the border, at ſome diſtance from the roots, with all poſſible care not to diſturb or break them. When the dry weather comes on, a few ſods pared off from a paſture ground, and laid upon the ſurface of the border, about the roots of the trees, with the graſs downward, will preſerve a gentle moiſture in the earth, and be leſs apt to harbour inſects, than any ſort of dung or litter.

The above is the uſual method of tranſplanting trees from the nurſery to a wall. But Mr. Miller is convinced, from experience, that, inſtead of taking from the nurſery ſtocks (eſpecially of peaches and nectarines) which have then made one year's ſhoots from the bud, it is better to ſingle out ſuch as were budded the preceding ſummer, and have not made any ſhoot; provided the bud be ſound and plump, and the bark of the ſtock well cloſed at the place of budding; becauſe, when this ſhall have put forth a ſhoot five or ſix inches long, in the following ſpring after being tranſplanted, as it will ſeldom fail to do, that ſhoot may be ſtopped by pinching off its top, and thereby be made to produce lateral ſhoots, which may be trained to the wall, without having any head to cut off, at muſt be done to thoſe trees which have had one year's growth in the nurſery. The benefit of avoiding this operation is particularly great to ſuch trees as are apt to bleed much, and ſingularly ſo to the moſt tender ſorts. The ſtock of the tree tranſplanted in bud, before it has made any ſhoots, muſt indeed be cut down, likewiſe in the ſpring, to juſt above the bud, becauſe this will rarely ſhoot unleſs that be done; and the nearer it is cut to the bud, the ſooner will the head of the ſtock be covered by the bud: for there is no occaſion to leave on trees which are planted againſt a wall, a part of the ſtock, above the bud, to faſten the ſhoots to, as muſt be done with thoſe in the nurſery; becauſe the ſhoots may here be immediately and properly ſecured, by faſtening them to the wall: nor is this cutting off the ſuperfluous part of the ſtock attended with any danger to the bud, if the wound be but covered with a little graſting wax, or clay, to keep out the wet.

No time is loſt, but ſome may be gained, by this practice; as the trees which have ſhot before their being tranſplanted muſt be cut down, and there is a hazard of their ſhooting again.

In watering of theſe new planted trees, which ſhould not be done unleſs the ſpring prove very dry, nor then often, or in great quantity, the pot ſhould have its noſſel on, ſo as to let the water out very gently, almoſt in drops only, as it were; for when it is poured down haſtily, it hardens the ground: and if the head of the tree is watered at the ſame time as its roots, and likewiſe gently, that refreſhing will be of great ſervice to it.

About the middle of May the ſhoots of theſe trees, of which there will then often be ſeveral ſix or eight inches long, ſhould be nailed horizontally to the wall. All foreright ſhoots, and ſuch as are weak, ſhould alſo then be rubbed off, to ſtrengthen thoſe that are left. But if no more than two ſhoots have been produced, and thoſe very ſtrong, the tops of theſe ſhould be nipped off

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at that time, and this will make each of them put out two or more ſhoots, whereby the wall will be the better furniſhed with branches. It will alſo be right to continue to refreſh them gently with water, from time to time, during the whole ſummer, if that ſeaſon ſhould be very dry, leſt their roots, having but little hold of the ground the firſt year after tranſplanting, ſhould be injured by the drought, ſo as to retard the growth of the tree.

In the beginning of October, when the trees have done ſhooting, it will be time to begin to prune them. In doing this, the branches muſt be ſhortened in proportion to the ſtrength of the tree; that is, if it be ſtrong, they may be left eight inches long; but if weak, they ſhould be ſhortened to four or five. The ſhoots thus cut ſhould then be trained horizontally to the wall, ſo as to leave the middle of the tree void of branches, for that part will be eaſily furniſhed with wood afterwards; whereas, if the ſhoots are trained perpendicularly to the wall, the ſtrongeſt will draw away the greateſt ſhare of the ſap from the roots, run upwards, and leave the ſide branches ſo deſtitute of nouriſhment, as frequently to occaſion their decaying and dying.

In the next ſummer, when the trees begin to ſhoot, they ſhould be carefully looked over again; all foreright or ill placed buds or ſhoots ſhould be rubbed off, and ſuch as are to remain, for future branches, ſhould be trained up horizontally to the wall, in due order, as they are produced; for this is the principal ſeaſon in which all fruit trees are beſt and moſt effectually modelled to their intended form. Every gentleman who wiſhes his trees to proſper to the utmoſt, and to grow with as much beauty as they are ſuſceptible of, ſhould therefore perſonally look over them at this time, and, with his own hand, rub off their ſuperfluous buds and ſhoots: for if this elegant and eſſentially uſeful part of gardening is left to the hired gardener, it will often be neglected, or ſlovenly performed. Whoſoever omits it, deſerves not to have good fruit. This important buſineſs ſhould not be deferred till Midſummer, as is the common practice, becauſe numbers of uſeleſs ſhoots, which muſt afterwards be cut off, will by that time have robbed the other parts of their due nouriſhment: and beſides, it is by ſtopping ſome of the ſtronger ſhoots (by nipping off their tops) in May, that they are made to put out ſide ſhoots, which, being guided to the vacant parts of the wall, furniſh every part thereof regularly with proper wood. Care muſt, however, be taken not to multiply theſe branches too much, for fear of weakening the tree ſo as to diſable it for producing good fruit; and therefore no ſhoots ſhould be ſtopped in the ſummer, unleſs there be an abſolute neceſſity for new branches in any particular place. Neither ſhould the branches be laid in too cloſe together againſt the wall, becauſe the great numbers of their leaves then exclude the air from their ſhoots, ſo that theſe are never duly ripened, and the fruit which is afterwards produced on them cannot, conſequently, be ſo well taſted as that of trees whoſe ſhoots receive all the advantages of the ſun and air, to bring them to maturity.

In the third year, the branches till then trained horizontally will have acquired ſuch ſtrength, that there will not be much danger in permitting ſome of their ſhoots to go in a more perpendicular direction, in order gradually to give the whole tree the form of a fan, which is by much the moſt beautiful, as well as the beſt way here, becauſe the wall is thereby moſt equally filled with wood.

It is in continuing ſtrictly to obſerve the two foregoing rules, viz. to furniſh every part of the tree as equally as poſſible with bearing wood, and not to lay the branches in too cloſe together, that the art of pruning fruit trees in general, and particularly wall trees, chiefly conſiſts. The former of theſe will always be completely effected by pinching off the tops of the young ſhoots, wherever an increaſe of wood is wanted, in May, as above directed. But as ſome have adviſed the doing of this in June, and others even later, we muſt remark here, that if we reflect that young ſhoots made ſo late in the year have not time to acquire a ſufficient ſtrength and ſolidity of fibres to reſiſt the winter's froſt, May will certainly be found to be a much more proper ſeaſon: for whoever caſts an attentive eye over fruit trees after a hard winter, will find many of their ſhoots killed by the preceding froſt; and if he looks ſtill more cloſely, he will ſee, that moſt, if not all, of theſe have been injudiciouſly forced out in a too late ſeaſon. It is almoſt needleſs to ſay that April, which others again recommend for this work, is too early; becauſe the wounded branch would then be in danger of being deſtroyed by a froſty night. If theſe directions are judiciouſly followed, it will not be neceſſary to touch any fruit tree with a knife in the ſummer: and that the avoiding of this will be of infinite ſervice to every ſpecies of them, is manifeſt from the many accidents to which they are liable when cut too much at that ſeaſon. All the ſoft, tender, and pithy wooded ſorts, ſuch eſpecially as the peach tree, require a conſiderable time to heal their wounds, when theſe are great, and in the mean while wet and rain eaſily ſoak into the wounded parts, ſo as frequently to make the branches canker and die.

As to the diſtance at which the branches of fruit trees, or rather the ſhoots of thoſe branches, ſhould be trained againſt a wall; nature gives us a ſure guide, if we but attend to the ſize of the fruit and of the leaves: for it ſhould be ſuch that neither of theſe upon an upper branch may touch the branch underneath.

The winter pruning, as it is called, of fruit trees is commonly performed in February or March: but the beſt ſeaſon for it is in October, when their leaves begin to fall; for that will be early enough for their wounds to heal before the froſt comes on, ſo that there will be no danger of their being hurt thereby. Thus all the aſcending ſap in the ſpring will be employed to nouriſh only thoſe uſeful parts of the branches which are left; whereas, if they are not pruned till February, the greateſt part of the ſap then in motion in the branches, as may be obſerved by the ſwelling of the buds, will be drawn up to the extreme parts of the branches, to nouriſh bloſſoms which muſt afterwards be cut off: for the extreme buds of ſtrong ſhoots always ſwell ſooner than moſt of the lower ones, and conſtantly draw from thoſe below.

It is the conſtant practice of gardeners, founded upon long experience, to prune weak trees early in the winter, that they may be leſs endangered by the cutting, and luxuriant trees late in the ſpring, in order to check their luxuriancy. See PRUNING.

WALNUT-TREE, *Juglans*, in botany, a genus producing male and female flowers on the ſame tree; the male flowers are diſpoſed in an oblong, cylindrical, imbricated amentum; the corolla of each flower is divided into ſix plane, equal, and elliptic parts, in the center of which is ſituated a number of very ſhort filaments, topped with erect, acuminated antheræ; the female flowers grow in ſmall cluſters, ſitting cloſe to the branches; the corolla of each is divided into four erect pointed ſegments; the fruit is a large, oval, dry, and unilocular drupe, incloſing a large oval nut with netted furrows, containing a kernel with four lobes, which are variouſly furrowed.

This tree was formerly held in great eſteem in this country, for its wood, which is, in fact, often very finely veined; but, on account of its aptneſs to be worm-eaten, it has of late given place to the beautiful and much ſounder mahogany, with which our cabinet-makers have been pretty plentifully ſupplied from the Britiſh ſettlements in the Weſt Indies.

As an uſeful fruit tree, independent of its timber, which is, however, ſtill of good value, it merits the huſbandman's attention; nor can the gentleman eaſily find a more ſtately one to adorn his park with, or to form a noble avenue to his manſion.

Theſe trees are raiſed from their nuts, which it is beſt to keep in dry ſand, with their outer covers on, till February; that being the right time for planting them. If they are intended for timber trees, they ſhould be ſown in the places where they are to remain, in order that the breaking or otherwiſe ſhortening of their roots, and eſpecially thoſe of the tap kind, may not ſtint their growth,

growth, and make them run out in branches: but if they are deſigned for fruit, their fertility will be increaſed by tranſplanting them, becauſe their downright roots, which are thoſe that chiefly encourage the luxuriant growth of wood in all ſorts of trees, will be thereby checked, and they will be made, in lieu of them, to ſtrike out numbers of lateral roots, which, as experience has proved, always conduce greatly to the production of the largeſt and faireſt fruit. The moſt proper ſeaſon for tranſplanting them is when their leaves begin to decay; and the beſt age, when they have had three or four years growth in the nurſery. Mr. Miller ſays he has frequently experienced that there is little danger of their ſucceeding, although they be eight or ten years old when they are tranſplanted: but, however that may be, it is certain that they will root beſt, grow largeſt, and laſt longeſt, if they are removed young. The leſs their branches are cut at the time of tranſplanting, or indeed at any time after, the better they will proſper; for much lopping often cauſes them to decay: but if there be a neceſſity for taking off any of their boughs, it ſhould be done early in September, that the wound may have time to heal before the cold and wet comes on. It is likewiſe eſſential to cut the branch off quite cloſe to the trunk, leſt the ſtump which is left ſhould decay, and rot the body of the tree; to prevent which, eſpecially if the wound be large, it will be right to ſmooth it well with a chiſſel, and then to cover it over carefully with a cement of clay or wax, as in the caſe of grafting, with a piece of tarpawling, or of ſheet lead, over that.

Theſe trees ſhould not be planted nearer together than forty feet, and more may be yet better, if they are deſigned for fruit. They delight in a firm, rich, loamy ſoil, or ſuch as is inclinable to chalk or marl; and they will thrive very well in ſtony ground, or on chalky hills, as is evident from thoſe large plantations near Leatherhead, Godſtone, and Carſhalton in Surry, where great numbers of theſe trees planted upon the Downs produce annually large quantities of fruit, to the no ſmall advantage of their owners.

In order to preſerve this fruit, it ſhould be left upon the tree till it is thoroughly ripe, and then, as it would be exceedingly troubleſome to gather it by hand, it may be beaten off, but not with ſuch violence as is commonly uſed, from a miſtaken notion that the tree is improved thereby: for moſt certainly it cannot be benefited by that rough way of forcing off the young wood upon which this fruit grows. The nuts thus obtained ſhould be laid in heaps for two or three days, after which they ſhould be ſpread out, and when they have parted from their huſks, which they will then ſoon do, and have afterwards been well dried in the ſun, to remove the moiſture of their ſhells, which would otherwiſe make them mould, they ſhould be laid up a dry place, where neither mice nor other vermin can get at them. In this manner they will remain good for four or five months: or, which is a yet better way, and will keep them ſtill longer, let them, when their outward moiſture has been dried by the ſun, be put up in jars or other cloſe veſſels, with dry ſand between their interſtices. The laying of them for four or five hours in an oven gently heated, as is the practice of ſome, will indeed dry the gum, and prevent their ſprouting; but if the oven is too hot, it will make the kernels ſhrink, and prevent their being peeled with any tolerable eaſe.

Were it only for the oil that theſe nuts afford, the trees which produce them would be worth ſome care. Mr. Evelyn ſays that one buſhel of them will yield fifteen pounds of peeled kernels, and that theſe will yield half that weight of oil, which the ſooner it is drawn, is the more in quantity, though the drier the nut, the better in quality. He adds, that the lee, or marc of the preſſing, is excellent to fatten hogs with. Certainly it would be good manure for land; as are the cakes of linſeed, rape, &c. after the oil has been ſqueezed out of them. The green huſks boiled, without any mixture, make a good colour to dye a dark yellow. The kernel being rubbed upon any crack, or chink of a leaking veſſel, ſtops it better than either clay, pitch, or wax.

The French are very fond of the kernels of theſe nuts ſcooped out of the ſhells before they are hardened, with a ſhort broad braſs knife; becauſe iron ruſts and communicates a diſagreeable taſte to the kernels. When ſcooped out, they are ſteeped in ſalt and water for a few hours before they are ſet upon the table, as well to take off all taſte of bitterneſs, as to make them peel with the utmoſt eaſe.

WALRUS, in zoology, the Engliſh name of the phoca, with canine teeth exerted. See PHOCA.

This is much larger than the ſea-calf, or phoca, with the canine teeth covered; growing to the ſize of the largeſt ox; the head is very large, and almoſt of a rounded figure; the eyes are large and prominent; there are no ears, but only an aperture on each ſide of the head, of an oblong form, and not very large; the noſe is obtuſe; the noſtrils large, and the creature contracts and dilates them at pleaſure; the mouth is very large, and the upper part of it furniſhed with thick and cartilaginous whiſkers; the tongue is ſhort, the canine teeth of the upper jaw are of an enormous length and ſize, and they hang downwards and forwards toward the breaſt; the creature uſes theſe ſtrange weapons to climb upon the ice, and to hang itſelf to the rocks in its getting on ſhore to ſleep.

WALTHERIA, in botany, a genus of plants, whoſe flower conſiſts of five heart-ſhaped ſpreading petals, and the ſame number of ſhort ſtamina joining at their baſe: the fruit is an oval unilocular capſule, containing an obtuſe ſeed, which is broadeſt at the top.

WANLASS, in hunting. Driving the wanlaſs, is the driving of deer to a ſtand, that the lord may have a ſhoot, which is one of the cuſtomary ſervices of fiefs.

WAPENTAKE (from the Saxon) the ſame with what we call a hundred, and more eſpecially in the northern counties beyond the river Trent. There have been ſeveral conjectures as to the original of the word; one of which is, that anciently muſters were made of the armour and weapons of the inhabitants of every hundred; and from thoſe that could not find ſufficient pledges of their good abearing, their weapons were taken away, and given to others; whence it is ſaid this word is derived.

WAR, a conteſt or difference between princes, ſtates, or large bodies of people, which not being determined by the ordinary meaſures of equity and juſtice, is referred to the deciſion of the ſword.

Holy WAR, was that anciently maintained by leagues and croiſades, for the recovery of the Holy-land.

WARD, in law-books, a word of divers ſignifications: thus a ward in London, is a part of the city committed to the ſpecial charge of one of the aldermen of the city. There are twenty-ſix wards in London, which are as hundreds, and the pariſhes thereof as towns. A foreſt is alſo divided into wards, and ſo are moſt of our hoſpitals.

WARD, WARDA, or WARDAGIUM, is alſo uſed, in our ancient writings, for the cuſtody of a town or caſtle, which the tenants and inhabitants were bound to keep at their own charge.

WARD-HOOK, or WADD-HOOK, in gunnery, a rod of ſtaff with an iron end turned ſerpent-wiſe, or like a ſcrew, to draw the wadding out of a gun when it is to be unloaded.

WARDEN, or GUARDIAN, one who has the charge or keeping of any perſon, or thing, by office.

Such is the warden of the Fleet, the keeper of the Fleet-priſon; who has the charge of the priſoners there, eſpecially ſuch as are committed from the court of chancery for contempt.

Warden, in an univerſity, is the head of a college; anſwering to what in other colleges we call the maſter thereof. Warden, or lord warden of the Cinque Ports, is the governor of theſe noted havens; who has the authority of an admiral, and ſends out writs in his own name. Warden of the mint, is an officer whoſe buſineſs it is to receive the gold and ſilver bullion brought in by the merchants, to pay them for it, and overſee the other officers.--He is called keeper of the exchange and mint.

WARDROBE, a cloſet, or little room adjoining to a bed-chamber, ſerving to diſpoſe and keep a perſon's apparel in; or for a ſervant to lodge in, to be at hand to wait, &c.

Wardrobe, in a prince's court, is an apartment wherein his robes, wearing apparel, and other neceſſaries are preſerved under the care and direction of proper officers; as the maſter of the wardrobe, clerk, &c. of the wardrobe.

WARNING-PIECE, in the military art, is the gun which is fired every night about ſun-ſet, to give notice to the drums and trumpets of the army to beat and ſound a retreat or tattoo, which is likewiſe ſetting the watch.

WARNING-WHEEL, in a clock, is the third or fourth, according to its diſtance from the firſt wheel. See the article CLOCK.

WARP, in the manufactures, is the threads, whether of ſilk, wool, linen, hemp, &c. that are extended lengthwiſe on the weaver's loom; and acroſs which the workman by means of his ſhuttle paſſes the threads of the woof, to form a cloth, ribbon, fuſtian, or other matter.

For a woollen ſtuff to have the neceſſary qualities, it is required that the threads of the warp be of the ſame kind of wool, and of the ſame fineneſs throughout; that they be ſized with Flanders or parchment ſize, well prepared, and that they be in ſufficient number with regard to the breadth of the ſtuff to be wrought.

To WARP *a ſhip*, is to ſhift her from one place to another, when the wind and tide will permit it without danger.

WARRANT, an act, inſtrument, or obligation, whereby a perſon authoriſes another to do ſomething which he otherwiſe had not a right to do.

Warrant of attorney, is that whereby a man appoints another to do ſomething in his name, and warrants his action.

It ſeems to differ from a letter of attorney, which paſſes under the hand and ſeal of him who makes it, before creditable witneſſes; whereas warrant of attorney, in perſonal, mixed, and ſome real actions, is put in of courſe by the attorneys for the plaintiffs or defendants.

WARRANTY, *Warrantia*, a promiſe or covenant by deed, made by the bargainer for himſelf and his heirs, to warrant and ſecure the bargainee and his heirs againſt all men for enjoying the thing agreed on between them.

WARRANTIA CHARTÆ, a writ that lies for a perſon who is infeoffed in lands and tenements, with clauſe of warranty, and is impleaded in an aſſize, or writ of entry, wherein he cannot vouch or call to warranty. See VOUCHER.

WARRANTIA DIEI, a writ which lies in caſe where a man having a day aſſigned to appear perſonally in court to an action wherein he is ſued, is, in the mean time, by commandment employed in the king's ſervice; ſo that he cannot come at the day aſſigned.

WARREN, *Warrena*, a franchiſe, or place privileged either by preſcription or grant from the king, to keep beaſts and fowl of warren in; as rabbits, hares, partridges, pheaſants, &c.

By ſtatute 21 Edward III. a warren may lay open, and there is no need of cloſing it in, as there is a park.

In the ſetting up a warren, great caution is to be uſed for the fixing upon a proper place, and a right ſituation. It ſhould always be upon a ſmall aſcent, and expoſed to the eaſt or ſouth. The ſoil that is moſt ſuitable, is that which is ſandy; for when the ſoil is clayey or tough, the rabbits find greater difficulty in making their burrows, and never do it ſo well; and if the ſoil be boggy or mooriſh, there would be very little advantage from the warren, for wet is very deſtructive of theſe animals.

All due precautions muſt be taken, that the warren be ſo contrived, that the rabbits may habituate themſelves to it with eaſe. Many would have it that warrens ſhould be encloſed with walls; but this is a very expenſive method, and ſeems not neceſſary nor adviſable; for we find but very few that are ſo, and thoſe do not ſucceed at all the better for it.

The dung of rabbits is a great fertilizer of uſeleſs lands, and Mr. Mortimer tells us that he has known vaſt crops of rye upon barren lands that have been old warrens well dunged by rabbits; and large oak and aſh upon the ſame, though the ſoil was very ſhallow.

WART, *Verruca*, in ſurgery, a little round hard excreſcence ariſing from the fleſh like a pea.

A wart begins at the cutis, and ſeems to be either an effloreſcence of the ſerum of the blood, which hardening in the ſurface of the ſkin, makes a dry tumour; or elſe ſome ſmall luxuriancy of the little arteries of the cutis, which thruſt themſelves out, making a pretty ſarcoma, which we call a ſoft wart.

According to the variety of the tumour, it is ſometimes whole with a ſmooth ſurface, and ſometimes chapped and uneven.

The method of cure which deſerves to be firſt mentioned, is by ligature or vincture; this is performed upon ſuch of theſe excreſcences as are ſlender about the roots, and in a manner pendent, by firmly tying about them a horſe-hair, or a ſilken or linen thread; the warts, being thus deprived of the juices which nouriſh them, through a conſtriction of the veſſels by the ligature, gradually wither and fall away.

Another method of cure, is the ſurgeon's inſtrument, with which the wart is taken up by a hook or forceps, and then very nicely ſeparated by the ſciſſars. The wound is treated for ſome time with an application of the lapis infernalis, or ſome other corroding medicine, that if any part of a root ſhould remain, from which a new tubercle might ariſe, it might be conſumed and deſtroyed.

The cure by cauſtics is beſt performed by cutting off the hard upper part of the wart, with a razor or ſciſſars, and then ſurrounding its bottom with a circle of wax to prevent the ſpreading of the remedies; to touch it daily with oil of tartar, ſpirit of ſalt, aqua fortis, or butter of antimony.

The cure by cautery is performed by chooſing a cautery of a proper ſize, and with that burning down to the root of the wart. This is the moſt painful of all the methods of extirpating theſe excreſcences, but the pain is but for a moment, and the warts extirpated this way never return.

The cure by evulſion, is performed by anointing them with ſoftening ointment, and then ſeizing them artfully between the thumb and fore-finger, and forcibly wrenching them out. This is a mountebank method, and a bad one; for it is not only very painful, but the warts commonly grow up again.

When warts are found to look livid and blue, it is beſt to let them alone entirely; becauſe, when irritated, they frequently degenerate into a cancer. See CANCER.

WART-WORT, *Tithymalus*, in botany. See TITHYMALUS.

WASH, among diſtillers, the fermentable liquor uſed by the malt-diſtillers. See DISTILLERY.

It ſhould be about the ſtrength of the ten ſhilling ſmall-beer; and if the ſpirit be expected fine, it had better be too thin than too thick. It is only made by mixing the water hot with the malt ground into meal. If the water be too hot, the mixture will become gluey; and if too cool, a part of the virtue of the malt will be loſt. Under the right application of the water is to be conſidered the proper manner of agitating the maſs, ſo that all the parts of the aqueous fluid may come fully and freely in contact with the ſoluble particles of the ſubject.

When once the water is well ſaturated by ſtanding on the malt a proper time, it muſt be drawn off, and freſh poured on, till at length the whole virtue, or all the ſugary ſweetneſs of the malt, is extracted, and nothing but a fixed huſky matter remains behind, incapable of being farther diſſolved by the action of hot or boiling water; or of being advantageouſly waſhed or rinſed out by the bare affuſion of cold.

This artificial and external agitation or ſtirring about of the maſs, is neceſſary, not only in the common way of brewing for the malt-diſtillery, but alſo in that more expeditious way, now in uſe with ſome, of reducing the operations of brewing and fermenting to one, and grinding the malt to a fine meal, which is to be kept in the

waſh during the whole time, and even put into the ſtill with it and worked together.

The ſtirring may be repeated to great advantage more than once in each operation, as at the affuſion of every parcel of freſh water, in the common way, and at any ſhortly diſtant times in the ſhort way, in which it is of greater ſervice.

The action of fermentation works ſuch a change in the body of the tincture or ſolution, called the waſh, as to render it ſeparable by diſtillation, into parcels of matter that are ſpecifically different, and of a nature entirely foreign to what the ſame liquor would have yielded without the fermentation.

WASHING, in painting, is when a deſign, drawn with a pen or crayon, has ſome one colour laid over it with a pencil, as Indian-ink, biſtre, or the like, to make it appear the more natural, by adding the ſhadow of prominences, apertures, &c. and by imitating the particular matters, of which the thing is ſuppoſed to conſiſt.

Thus they waſh with a pale red to imitate brick and tile; with a pale Indian blue, to imitate water and ſlate; with green, for trees and meadows; with ſaffron or French-berries, for gold or braſs; and with ſeveral colours for marbles. Theſe waſhes are uſually given in equal teints or degrees throughout, which are afterwards brought down and ſoftened over the lights with fair water, and ſtrengthened with deeper colours for the ſhadows.

Some colours are of ſuch a gritty, ſandy nature, that it is impoſſible to grind them ſo fine as ſome curious works require; therefore, in order to get forth the flour and fineneſs of the colour, it muſt be waſhed, which is done thus: Take what quantity of colour you pleaſe to waſh, and put it into a veſſel of fair water; ſtir it about till the water be all coloured therewith, and if any filth ſwim on the top of the water, ſcum it clean off; and, when you think the groſſeſt of the colour is ſettled at the bottom, then pour off that water into another earthen veſſel, that is large enough to contain the firſt veſſel full of water four or five times; then pour more water into the firſt veſſel, ſtir the colour that remains till the water be thick; and after it is a little ſettled, pour the water alſo into a ſecond veſſel, and fill the firſt veſſel again with water, ſtirring it as before; continue to do this till you find all the fineſt of the colour drawn forth, and none but coarſe gritty ſtuff remain in the bottom; then let this water in the ſecond veſſel ſtand to ſettle till it is perfectly clear, and that all the colour be ſunk to the bottom; which when you perceive, then pour the water clear from it, and reſerve the colour in the bottom for uſe, which muſt be perfectly dried before you mix it with oil to work.

The colours thus ordered, are red lead, blue and green bice, verditer, blue, green ſmalt, and Spaniſh brown, when you would cleanſe it well from ſtones for ſome fine work, as alſo yellow ochre, when you intend to make gold ſize of it.

WASHING *of Ores*, the purifying an ore of any metal, by means of water, which would otherwiſe render it difficult of fuſion; this operation Cramer orders to be done as follows: Break the ore to a coarſe powder in an iron mortar, weigh twenty or thirty docimaſtical centners of it, put them into the waſhing trough, and pour ſome water upon them, that the ore may be thoroughly moiſt; then have a veſſel full of water, the diameter of which muſt be a little larger than the length of the trough; take the trough with the left hand, by the top of the hinder part, and dipping it horizontally into the water, move it gently with the right-hand from the forepart of the trough, which is always to be made the ſhallower part of it, toward the hinder part, which is deeper; then take out the trough; and incline it a little on the forepart, that the water may run out, and the heavier metallic part remain at the bottom; repeat this ſeveral times till the remains at the bottom of the trough are quite pure. If the ſtone in which the ore is lodged be too hard for powdering in its natural ſtate, as the flinty and debaſed cryſtalline ones commonly are, the whole muſt be calcined, and quenched in cold water ſeveral times over, and afterwards powdered and waſhed in this manner: When it is thus waſhed, aſſay a centner of it, and from the bead of metal this yields, it will be eaſy to eſtimate the value of the ore.

WASHING, or WASHES, among goldſmiths, coiners, &c. are the lotions whereby they recover the particles of gold and ſilver out of the ſweep, that is, aſhes, earths, ſweepings, &c.

This is either performed by ſimply waſhing them again and again, or by putting them in the waſhing-mill.

To make one of theſe waſhes, they not only gather together the aſhes of the furnaces, and ſweepings of the work-ſhops, but they alſo break and pound the old earthen crucibles and the very bricks of which the furnaces are built; little particles of gold, &c. being found to ſtick to them by the crackling natural to thoſe metals, when in their laſt degree of heat.

Theſe matters, being ground and mixed together, are put in large wooden-baſons, where they are waſhed in ſeveral waters, which run off by inclination into troughs underneath; carrying with them the earth, and the inſenſible particles of the metals, and only leaving behind them the larger and more conſiderable ones which are viſible to the eye, and taken out by the hand without more trouble.

To get out the finer parts gone off with the earth, they uſe quickſilver and a waſhing-mill. This mill conſiſts of a large wooden trough, at the bottom of which are two metalline parts, ſerving as mill-ſtones; the lower being convex, and the upper, which is in form of a croſs, concave.

A-top is a winch placed horizontally, which turns the upper piece round; and at bottom, a bung to let out the water and earth, when ſufficiently ground.

To have a waſh, then, the trough is filled with common water, into which they caſt thirty or forty pounds of quickſilver, and two or three gallons of the matter remaining from the firſt lotion. Then turning the winch, they give motion to the upper mill-ſtone, which grinding the matter and the quickſilver violently together, the particles of gold and ſilver become the more eaſily amalgamated therewith. This work they continue for two hours, when, opening the bung, the water and earth run out, and a freſh quantity is put in.

The earths are eaſily thus paſſed thro' the mill three times, and the ſame quantity of mercury uſually ſerves all the three times. When there is nothing left in the mill but the mercury united with the gold or ſilver which it has amalgamated, they take it out, and waſhing it in divers waters, they put it in a ticken-bag, and lay it in a preſs to ſqueeze out the water, and the looſe quickſilver; the remaining quickſilver they evaporate by fire, in a retort, or an alembic. The metal which remains they refine with lead, or part it with aqua-fortis.

WASP, in zoology, an inſect with four wings, and ſix feet; its body is yellow, with black triangular ſpots: the common waſp breeds in the ground. There is another kind much more fierce, but very rare: theſe breed in woods and mountains; they are larger, and have broader bodies, and much more black about them; their ſting is ſo large, that it ſeems diſproportioned to the ſize of their bodies.

To theſe are to be added the ichneumon waſps, which are ſmaller than the others, and have very ſlender bodies, but of the ſame colours with the common kind: they uſually live in the holes of mud-walls, and make a ſort of porch of mud before the doors of their habitations.

There is alſo another waſp common about Vienna; this is three times as large as the common kind, and ſeems of two different ſpecies, the one having rough antennæ, and the other ſmooth; they are both variegated with black and a bright yellow. *Mouffet's Hiſt. Inſect.*

WASP-FLY, in natural hiſtory, a ſpecies of fly, having very much the external figure of a waſp, but harmleſs, without a ſting, and with only two wings.

WASP TIPULA, in natural hiſtory, the name of an inſect deſcribed by Mr. Reaumur, and being properly a tipula, or long-legs, tho' greatly reſembling a waſp.

WAST, or WASTE, *Vaſtum*, in law, has divers ſignifications. It is uſed for a ſpoil, made either in houſes, woods, lands, &c. by the tenants for life, or for years, to the prejudice of the heir, or of him in reverſion or remainder.

Upon this the writ of waſte is brought for the recovery of the thing waſted, and treble damages.

WASTE *of the Foreſt*, is properly where a man cuts down his own woods within the foreſt, without licence of the king or lord chief juſtice in eyre.

WASTE is alſo taken for thoſe lands which are not in any man's occupation, but lie common.

They ſeem to be ſo called, becauſe the lord cannot make ſuch profit of them, as of his other lands, by reaſon of the uſe others have thereof, for paſſing to and fro. Upon this none may build, cut down trees, &c. without the lord's licence.

WASTE *of a Ship*, is that part of her between the main and fore-maſt.

WASTE-BOARDS, are boards ſometimes ſet upon the ſide of a boat, or other veſſel, to keep the ſea from breaking into her.

WASTE-CLOTHES, in a ſhip of war, the ſame with fights.

WATCH, in the art of war, a number of men poſted at any paſſage, or a company of the guards who go on the patrol.

Watch alſo implies a perſon poſted as a ſpy in any place, to have an eye thereto, and to give notice of what paſſes. A watch is properly intended for the apprehending of rogues in the night, as ward is for the like purpoſe in the day-time; and for default to watch and ward, the townſhip, &c. is puniſhable. It is ordained, that in all towns between Michaelmas day and the day of Aſcenſion, there ſhall be night-watches kept in each city, with ſix men at every gate, and ſix or four in a town. Alſo every borough is to have twelve men to watch therein, or otherwiſe in proportion to the number of the inhabitants in the place, from ſun-ſet to ſun-riſing, who are to arreſt ſtrangers ſuſpected, and diſturbers of the peace, &c. and may juſtify the detaining of them till the morning; or they may deliver them to the conſtable, in order to be carried before a juſtice.

At ſea, the term watch denotes a meaſure or ſpace of four hours, becauſe half the ſhip's company watch, and do duty in their turns, ſo long at a time; and they are termed ſtar-board watch, and lar-board watch.

WATCH is alſo uſed for a ſmall portable movement or machine for the meaſuring of time; having its motion regulated by a ſpiral ſpring. See SPRING.

Watches, ſtrictly taken, are all ſuch movements as ſhew the parts of time; as clocks are ſuch as publiſh it, by ſtriking on a bell, &c. But, commonly, the name watch is appropriated to ſuch as are carried in the pocket, and clock to the large movements, whether they ſtrike or not. See the article CLOCK.

The ſeveral members of the watch part are, 1. The ballance, conſiſting of the rim, which is its circular part; and the verge, which is its ſpindle, to which belong the two pallets or levers that play in the teeth of the crown-wheel. 2. The potence, or pottance, which is the ſtrong ſtud in pocket watches, whereon the lower pivot of the verge plays, and in the middle of which one pivot of the ballance-wheel plays; the bottom of the potence is called the foot, the middle part the noſe, and the upper part the ſhoulder. 3. The cock, which is the piece covering the ballance. 4. The regulator or pendulum ſpring, which is the ſmall ſpring in new pocket watches, underneath the ballance. 5. The pendulum, whoſe parts are the verge, pallets, cocks, and the bob. 6. The wheels, which are the crown-wheel in pocket pieces, and the ſwing-wheel in pendulums, ſerving to drive the ballance or pendulum. 7. The contrate-wheel, which is that next the crown wheel, &c. and whoſe teeth and hoop lie contrary to thoſe of other wheels; whence the name. 8. The great or firſt wheel, which is that the fuſee, &c. immediately drives: after which are the ſecond wheel, third wheel, &c. 9. Laſtly, between the frame and dial plate, is the pinion of report, which is that fixed on the arbor of the great wheel, and ſerves to drive the dial-wheel, as that ſerves to carry the hand.

Spring, or *Pendulum* WATCHES, are pretty much upon the ſame principle with pendulum clocks, whence their denomination.

If a pendulum deſcribing little arches of a circle make vibrations of unequal length in equal times, it is by reaſon it deſcribes the greater with greater velocity. For the ſame reaſon a ſpring put in motion, and making greater or leſs vibrations, as it is more or leſs ſtiff, and as it has a greater or leſs degree of motion given it, performs them nearly in equal times. Hence, as the vibrations of the pendulum had been applied to large clocks to rectify the inequality of their motions; ſo, to correct the unequal motions of the ballance of watches, a ſpring is added, by the iſochroniſm of whoſe vibrations the correction is to be effected.

The ſpring is uſually wound into a ſpiral, that, in the little compaſs allotted it, it may be as long as poſſible, and may have ſtrength enough not to be maſtered and dragged about by the inequalities of the ballance it is to regulate.

The vibrations of the two parts, viz. the ſpring and ballance, ſhould be of ſome length; only ſo adjuſted, as that the ſpring, being more regular in the length of its vibrations than the ballance, may on occaſion communicate its regularity thereto.

The invention of ſpring or pocket watches, is owing to the artiſts of the preſent age. It is true, we find mention made of a watch preſented to Charles V. in the hiſtory of that prince; but this in all probability was no more than a kind of a clock to be ſet on a table, ſome reſemblance whereof we have ſtill remaining in the ancient pieces made before the year 1670.

In effect, it is between Dr. Hooke and Mr. Huygens, that the glory of this excellent invention lies, but to which of them it properly belongs, is greatly diſputed; the Engliſh aſcribe it to the former, and the French, Dutch, &c. to the latter. Mr. Derham, in his Artificial Clock-maker, ſays plainly that Dr. Hook was the inventor; and adds, that he contrived various ways of regulation. One was with a load-ſtone: another with a tender ſtraight ſpring, one end whereof played backwards and forwards, with the ballance; ſo that the ballance was to the ſpring, as the bob to a pendulum; and the ſpring, as the rod thereof. A third method was with two ballances, of which there were divers ſorts, ſome having a ſpiral ſpring to the ballance for a regulator, and others without. But the way that prevailed, and continues in mode, was with one ballance and one ſpring running round the upper part of the verge thereof; though this has a diſadvantage which thoſe of two ſprings, &c. were free from, in that a ſudden jerk or confuſed ſhake will alter its vibrations, and put it in an unuſual hurry.

The time of theſe inventions was about the year 1658, as appears, among other evidences, from an inſcription on one of the double-ballance watches preſented to king Charles II. viz. Robert Hooke invent. 1658, T. Tompion fecit, 16. The invention preſently got into reputation, both at home and abroad; and two of them were ſent for by the dauphin of France.

Soon after this, Mr. Huygens's watch, with a ſpiral ſpring, got abroad, and made as great noiſe in England, as if the longitude could be found out by it. It is certain, however, that his invention was later than the year 1673, when his book De Horol. Oſcillat. was publiſhed, wherein he has not one word of this, though he has of ſeveral other contrivances in the ſame way. For the principles of Mr. Harriſon's watch for finding the longitude at ſea, ſee LONGITUDE.

Aſtronomical WATCH, a machine invented by Mr. Neale, for ſolving ſeveral aſtronomical problems. It has two glaſſes; that in the front covers a dial plate, as in common watches; the other on the back-ſide, covers a plate forming a ſegment of a globe, on which are drawn twenty-four meridian lines, with the names of ſo many countries, at 15° difference of longitude from each other. This plate makes an entire revolution in twenty-four hours; and, conſequently every country thereon

paſſes

paſſes by the ſun. Round this plate is a circle divided into twenty-four hours, alſo at reſt; by means of which, when the moveable plate is made to correſpond with the true time, ſhewn by the hands on the common ſide, the time of day or night, at the ſeveral countries ſpecified, is ſhewn by the hour-circle. Round the moveable plate, and between it and the circle of hours above deſcribed, moves a narrow circle, on which is engraved the moon's age; and over $29\frac{1}{2}$ is placed an ivory ball, repreſenting the moon: and at right angles each way, are placed two pins, one eaſtward, and the other weſtward; by means of which, the time of the moon's riſing, ſouthing, and ſetting, at thoſe different places, is ſhewn in a very entertaining manner. Several other uſeful aſtronomical problems may alſo be ſolved thereby.

Striking WATCH, one which, beſides the common watch-work for meaſuring time, has a clock-part for ſtriking the hours; ſo that, properly ſpeaking, they are pocket-clocks. See CLOCK.

Repeating WATCH, one that by only pulling a ſtring, puſhing in a pin, &c. repeats the hour, quarter, or minute, at any time of the day or night.

WATCHING, or WAKEFULNESS, *Inſomnia*, in medicine, is produced by too great a determination of the nervous fluid to the organs of the ſenſes, whereby theſe organs are prepared to receive, readily, any impreſſion from external objects, which they propagate to the brain, and furniſh the ſoul with divers occaſions of thinking. This extraordinary flux of ſpirits may have two cauſes; for, 1. The ſenſible objects may ſtrike the organ with too much force. In which caſe, the animal ſpirits being violently agitated, and thoſe agitations continued by the nerves to the brain, they give a like motion to the brain itſelf; the neceſſary conſequence of which is, that the animal muſt wake. Thus, a loud ſhriek, pains, headach, gripes, coughing, &c. cauſe waking. And the ſoul's being oppreſſed with cares, or deeply engaged in thinking, contributes to the ſame, ſince, as it acts by the miniſtry of the ſpirits, any cares or meditations that keep them in motion, muſt produce watchfulneſs. Of this kind are thoſe inveterate wakings of melancholic perſons, ſome of whom have been known to paſs three or four weeks without a wink of ſleep.

2. The other cauſe is in the ſpirits themſelves, which have ſome extraordinary diſpoſition to receive motion, or to perſiſt in it: as from their too great heat, or that of the brain, in fevers, &c. Hence it is, that the diſorder is moſt frequent in ſummer, in the heat of youth, &c.

Long faſting has the ſame effect; the want of food ſubtilizing the ſpirits, and drying the brain. The ſame is likewiſe an ordinary ſymptom in old age, by reaſon the pores of the brain and nerves having been much widened by the continual paſſage of ſpirits for a great number of years, the ſpirits now paſs and repaſs through them with too much eaſe, and need not any extraordinary motion to keep the mind awake.

There are inſtances of waking forty-five nights ſucceſſively; and we even read of a melancholy perſon, who never ſlept once in fourteen months. Such watchings uſually degenerate into madneſs.

When the cauſe is known, it muſt be removed, if poſſible, and the irritated ſpirits muſt be appeaſed with emulſions, eſpecially of poppy ſeeds, or with the thebaic tincture, or theriaca, and other opiates in general, not neglecting the original diſeaſes. In fevers, a moiſt ſoft moiſtening diet is beneficial; as alſo preparations of barley, emulſions of poppy-ſeeds and almonds, decoctions of ſcorzonera roots, almond cream, and winter ſlummery uſed as aliment: likewiſe tea made of cowſlip flowers, and gentle laxatives.

When the patient is reſtleſs and wakeful the night before a criſis, no hypnotics ſhould be given.

When there is no other diſeaſe, the patient ſhould ſhun all care and intenſe thinking, eſpecially in the evening: he ſhould alſo uſe exerciſe, and eat light ſuppers. If it is cauſed by pains, they ſhould be appeaſed by antiſpaſmodics, things which temperate, and diaphoretics; and if theſe will not do, mild opiates muſt be added. In old perſons, all care and ſolitude muſt be baniſhed; the mind ſhould be quiet, and the moderate uſe of generous wine may be allowed in the evening; likewiſe medicines of amber and muſk will be proper, and confectio alkermes or theriaca with wine. The drinking of hot-water, and principally coffee, muſt be forbid after dinner.

WATER, in general, implies a pellucid fluid, convertible into ice by cold; naturally pervading the ſtrata of the earth, and flowing or ſtagnating on its ſurface.

Pure water would require a definition very different from this, that of a limpid and colourleſs liquor, without ſmell or taſte, ſimple, and volatile. But ſuch a definition would not include the waters impregnated with metalline, ſtony, ſaline, and other foſſile particles.

Waters may be arranged under two general diviſions:

1. The common waters ſerving for the ordinary purpoſes of life.

2. The waters impregnated with peculiar mineral ſubſtances. The differences of common water, ariſing from the circumſtances of ſtagnation or motion, or of its containing more or leſs of thoſe ſtony particles, which it always contains in ſome degree, are not ſo eſſential, as to prevent the whole from being conſidered as of only one kind.

The waters impregnated with peculiar mineral ſubſtances, on the other hand, differ eſſentially, in regard to the ſeveral impregnating matters, and are properly arranged, according to them, into four kinds:

1. Waters impregnated with metalline particles.
2. Waters impregnated with ſaline particles.
3. Waters impregnated with ſulphureous particles.
4. Waters impregnated with terrene particles.

Common WATERS, or ſuch as ſerve the ordinary purpoſes of life.

A fluid of this kind, ſo well calculated for the diſſolving and ſuſtaining, in a ſtate of ſolution, many of the ſubjects of the mineral kingdom, cannot but, in its paſſage through the earth, be more or leſs impregnated with many of the bodies it waſhes in its courſe. We accordingly meet with it in different places, impregnated in various manners and degrees, with various ſubſtances, ſome in greater, ſome leſs proportion, and ſome more, ſome leſs perceptible to our ſenſes. According to the teſtimony of thoſe imperfect judges, we uſually divide water into two general kinds, the ſimple and the medicinal.

Simple, or pure water, in a juſt ſenſe of the word, is not met with any where: heterogeneous matter, and that in a large quantity, may be ſeparated from ſuch as appears the pureſt and moſt ſimple; but we include, in a more general manner, under the firſt of theſe terms, all thoſe waters which have no ſmell or taſte of any extraneous matter, nor any particular effect on the body; and under the latter we include all thoſe whoſe ſmell, taſte, or other obvious qualities, denote their containing ſaline, metalline, or other mineral particles in them, and whoſe effects on the body correſpond with theſe notices of their contents.

The waters of the firſt general kind are uſed in the common occaſions of life, thoſe of the other are taken as medicines to reſtore decayed health.

Simple water, to uſe the received phraſe, is a pellucid colourleſs fluid, inſipid to the taſte, and without ſmell; we meet with this under different circumſtances, and accordingly divide it into ſpring-water, well-water, river-water, pond-water, rain-water, and ſnow-water. The firſt is the water furniſhed us from the bowels of the earth, and is continually freſh ſupplied; the ſecond is the ſame water, only with the difference of its remaining long in the ſame place before we have it; the third is a mixture of the firſt, and of freſh vapours raiſed from the ſea and freſh waters, and deſcending in rains. The two firſt are almoſt invariably the ſame; the latter is ſubject to a thouſand changes, from the matters accidentally waſhed into it by the torrents occaſioned by rains; but it has the advantage of being in continual motion. The fourth is much the ſame in its nature with this, but is rather more owing to water that has been raiſed in vapour, and has fallen again in rain; this has alſo the diſadvantage of ſtanding and ſtagnating

in its place. The fifth has the advantage of being wholly raiſed in vapour, and, as it were, diſtilled by nature: it is, conſequently, purer than any of the others; but there are ſo many kinds of particles capable of riſing with the water in vapour, that it never can be, nor ever is perfectly pure. The laſt has all the advantage of this, and the additional one, of having been frozen in its paſſage, and thus having paſſed through an operation very well calculated for the ſeparating of heterogeneities of many kinds.

Upon the whole, the laſt, or ſnow-water, bids fair for being the pureſt and fitteſt for our common uſe, of any that comes in our way; yet even this we have found, by experiments, not to be abſolutely pure.

It has been objected to ſnow-water, that it occaſions ſwellings in the throats of people who are obliged to drink it; but if we examine ſtrictly into the origin of this charge againſt it, we ſhall be induced to acquit it. Errors are eaſily taken up and quickly propagated. It has been early obſerved, that the people who inhabit the Alps had ſwelled throats almoſt univerſally; one of the firſt people who made this obſervation, attributed it to their drinking a water different from that which other people drank, it being, at leaſt for a great part of the year, little other than the melted ſnow, with which the tops of thoſe mountains are covered. Snow-water thus got the ſcandal of occaſioning an ill effect, which people did not ſee the cauſe of, and it has retained its ill name, on the occaſion, to this day. Things are not, however, the more true, for being generally received as truths, nor does this ſeem to deſerve at all the credit that it has had for ſo many ages. We ſee a fair trial of the effects of ſnow-water in our ſailors, who attend the Greenland whale-fiſhery: theſe people, for many months, have no other drink than ſnow-water, or they eat ſnow by way of drinking; yet ſwelled throats are not found to be the conſequence. On the other hand, we have a part of England, in which ſwelled throats, among the women at leaſt, are as common, if not as great, as among the Alpines. The women of many parts of Derbyſhire are almoſt univerſally ſubject to them; yet they do not drink ſnow-water any more than their neighbours.

Theſe are two ſimple facts, which one would wonder no body had enquired into before; but if by theſe it appears that ſnow-water may be drank without occaſioning ſwelled throats, and that ſwelled throats may be a general diſorder in certain places, without the drinking of ſnow-water, it ſhould ſeem very fair to conclude, that it is not ſnow-water which occaſions them in the Alps: tho' people have very firmly believed it for 2000 years; and when we have got rid of this vulgar prejudice, we ſhall find nothing to countenance the cenſure the world has ſo long paſſed upon what is doubtleſs the beſt and pureſt water we are naturally acquainted with.

All waters, as they are more pure, are more ſoft: this, as the pureſt, is the ſofteſt of all. Rain-water comes next to this; but both by experiments and analyſis, is found to be inferior to it: after rain-water, thoſe waters are the ſofteſt which are moſt formed of this, except when altered for the worſe by ſtagnation, or other accidents. Spring-water, though the cleareſt and moſt tempting of all to look at, is the leaſt pure, and, of all others, the leaſt fit for common uſe; and, conſequently, the other waters we meet with, which are all compoſed of a mixture of ſpring and rain-water, are the better and fitter for all the purpoſes of life, as they contain more of the rain-water, and leſs of the other.

The eye, we ſee, by the inſtance of the pellucidity and ſeeming purity of ſpring-water, is no adequate judge on this occaſion. It will teach us, indeed, not to uſe foul or dirty water, which would carry mud, and a multitude of other things we never ought or intend to ſwallow, into our ſtomachs; but it leaves us in the dark as to thoſe contents of water, which, in however great quantity, may be ſuſpended imperceptibly in it. In this caſe we are to judge by the effects of the water, and after having ſet aſide all ſtagnating water, as ſuch, for very obvious reaſons, we are to conſider the effects of the others in and out of the body.

Such water as ſits light upon the ſtomach is to be preferred to that which is heavier there: it ſhould have no ſenſible quality but that of mere water on the body. Water that boils ſooneſt and cools ſooneſt is to be preferred, and ſuch as boils garden ſtuff the quickeſt, and mixes the moſt readily and perfectly with ſoap.

The water produced from melted ſnow is ſuperior to all other kinds in theſe ſeveral reſpects, and is, doubtleſs, the laſt of all waters to be juſtly charged with the miſchievous effects aſcribed to it by the people who ſuppoſe that the ſwelled throats of the Alpines are occaſioned by it: what is the occaſion of ſo odd an effect, is not the buſineſs of this article to enquire into. Only it may be obſerved by the bye, that the Alps are known to abound in many places, and, perhaps, do ſo in many more, with the ſame ſort of mineral and foſſile ſubſtances, that are found in our county of Derbyſhire: and that the water the people who inhabit thoſe mountains drink, may be the occaſion of the diſorder, though it is very evident that it does not produce it, as a ſolution of ſnow.

The extraneous matter generally and univerſally contained in all waters, in its natural ſtate, is ſpar, a foſſile ſubſtance, which, though we are not able to diſſolve in water by any artificial means, yet we have the ſtrength of all proofs, that it is naturally diſſolved and ſuſtained in it, becauſe we can, at all times, ſeparate it from it in a ſolid form. This ſpar is, in itſelf, a pellucid foſſile, but it is uſually aſſociated with more or leſs earth, often with other particles. The earth gives it a foulneſs and opacity in its mixed ſtate, which, though not perceptible in the water, never fails to be ſo in the ſolid matter, when ſeparated from it.

This ſpar is, in ſome meaſure, ſeparated from all water by the common means of evaporation; and even in caſes wherein the operation is not carried to ſuch a height as to ſeparate it by an abſolute evaporation to a dryneſs in a large quantity at once; yet, in proportion to the water evaporated, a quantity of it is always precipitated to the bottom and ſides of the veſſel, which, though too ſmall to be perceptible, when only the produce of a few of theſe operations, yet, by degrees, increaſes in veſſels frequently uſed and not cleaned, and ſhews itſelf in a very evident manner.

This is the origin of that ſtony matter found concreted round the ſides of our tea-kettles; the ſeveral boilings of water in which add each their precipitation to the former, and the veſſel never being cleaned from it, the conſequence of repeated boilings, for a long time, is a cruſt of ſparry matter, of a thickneſs proportioned to the length of time it has been forming.

This ſubſtance, when examined, will be found to be juſt what has already been mentioned, as the precipitation of all water, a ſpar, more or leſs fouled with earth, according to the clearneſs or impurity of the water, and containing alſo more or leſs of cryſtalline particles. The water of rivers contains leſs of this ſpar than that of ſprings; and this is owing to its being compoſed in part of rain-water, which, tho' not abſolutely free from it, contains much leſs than that of ſprings; and, accordingly, thoſe rivers which are moſt dependent on rain, carry leaſt of this in their water. The ſeveral different ſprings, tho' they all carry greatly more of it than river or pond-water, yet differ greatly from one another in the quantity they hold of it; and, accordingly, we ſee the water of rivers is a much longer time in forming any conſiderable cruſt in theſe veſſels, than that of ſprings; and that the water of ſome ſprings produces it much quicker than that of others.

The uſes of common water in the various occaſions of life, and its ſervice in the animal œconomy, are ſufficiently known. Whatever are its virtues, caution is to be uſed as to the ſtate in which it is drank. People in health ought to drink it in a temperate ſtate; thoſe who are ſick ought, in whatever form it comes to them, to have it warmed. Water drank extremely cold, for a conſtancy, injures the nerves, and occaſions torpors, and even paralytic diſorders of the internal parts: it often alſo, gives violent cholics, and hurts the digeſtion; if drank in this ſtate, at a time when the body is heated with labour or exerciſe, there is no end of the diſorders it may occaſion, nor any thing more fatal than the miſ-

chiefs

chiefs that may attend it. On the other hand, warm water taken too copiouſly, and for a continuance, is not without its ill conſequences; it too much relaxes the fibres of the ſtomach, and the food, in conſequence of this, paſſes off not half digeſted.

Our Dr. Hancock has given cold water great praiſes as a medicine; he tells us of his having cured fevers of many kinds, and a number of other diſtempers, by giving a draught of it in the beginning of the diſeaſe, and ſuffering it to take its natural courſe, and act as a ſudorific. He orders ſix or eight ounces of it to be given to a child, a pint or a quart to grown perſons, at the coming on of the diſeaſe, or in intermittents, or in coming on of the fit. They are to be laid in bed firſt, but its operation is not to be promoted by any additions of covering: the whole body becomes ſoon after warm, and after this, uſually, a plentiful perſpiration ſucceeds. The firſt doſe frequently cures in intermittents, but a ſecond, or third, he tells us, very rarely fail.

The cold water method has been carried much farther in ſome countries, than it has been propoſed with us. People have been made to take it in chronic caſes, to the quantity of four, five, or ſix quarts a day, and this for a continuance of fourteen days, or three weeks, and little or no kind of any food allowed during the whole courſe. Some have been ſtarved by this meagre diſcipline; but it is affirmed that many have been cured by it.

In this practice, it is not expected that the water ſhould ſweat the patient, as Dr. Hancock would have it do; care is taken, on the contrary, that they are not ſuffered to ſweat after it, but it is to be voided by ſtool and urine: it is a method of practice, however, that is not likely to be put in practice among us.

Another great uſe of water, in a medicinal way, is in baths of the cold and of the warm kind. The latter are more agreeable to the patient, and very great effects have been produced from the former.

Warm baths are emollient, relaxing, and attenuating; they promote perſpiration, and take off the ſenſe of wearineſs and pain; they are often of great ſervice in nephritic caſes, and ſerve happily to bring out eruptions on the ſkin in many caſes, when nature is labouring at that end, and is oppreſſed in many other reſpects, becauſe not able to effect it,

Warm baths, however, are not to be indiſcriminately adviſed to all people; thoſe of plethoric habits, and thoſe in danger of paralytic complaints, are by no means to uſe them; and they are, in general, to be avoided in fevers, deliriums, diarrhæas, and hæmorrhages of whatever kind.

Cold baths have the exact contrary effects to the hot ones; they contract as much as the other relax the fibres. The beſt way of going into them is in a morning; and exerciſe, or elſe a warm bed, is to be recommended afterwards.

The Romans, we are told, had a method of plunging themſelves out of their hot baths into their cold ones. They did this to preſerve health, and to give them ſtrength and ſpirits. The American Indians are found in poſſeſſion of a ſecret of the ſame kind, but they uſe it as a cure for diſeaſes. They ſweat themſelves between hot turfs of earth, and in the midſt of this plunge themſelves into beds of ſnow: a ſtrange wild method! but not attended with the ill conſequences among them, that might be imagined.

Medicinal WATERS, are ſuch, as beſide the ſparry, earthy, and cryſtalline matter contained in all water, are impregnated with other mineral particles, and theſe either of the metalline or ſaline kind. Theſe waters are diſtinguiſhed by two general kinds, as they come forth out of the ground, either hot or cold. The names by which they are called are thermæ and acidulæ. The name of thermæ is properly enough given to the hot ones, expreſſing as much; but the other term, acidulæ, is not quite appoſite to the cold ones, becauſe they rarely contain an acid ſalt, but always an alcaline one. It was given them on account of a certain urinous, or, as ſome expreſs it, a ſubacid taſte, which many of the cold mineral waters have, when freſh drawn from the ſpring.

The particles with which the waters are impregnated, are, in general, of four kinds, metalline, ſaline, ſulphureous, or terrene. They cannot but be extremely frequent, as the ſubſtances they impregnate one or other of them, are in almoſt all parts of the earth. There are more than a thouſand in Germany alone. Our own Iſland affords a vaſt number, and ſcarce any known parts of the world but abound with them.

Copper and iron, being the two metals moſt eaſily ſoluble in water, are the moſt common in the impregnation of ſprings. The cupreous waters are found in places where there are mountains abounding in copper; and ſome of them are ſo ſtrongly impregnated with it, that they carry off the particles of iron laid in them, and leave the copper they contained in their place. This is called tranſmuting iron into copper; but that pompous name was only given to the operation, from an ignorance of the manner in which it was performed. The ferrugineous waters are much more frequent than the cupreous, and of much greater uſe to the world. Theſe, with the iron, uſually contain many other extraneous particles, earthy, and of other kinds, as appears by evaporation, and always a peculiar alcaline ſalt, to which they owe a great part of their qualities. They all have more or leſs of the ferrugineous taſte, and all diſcover the metal they contain, by putting a little powder of galls in them, as they become purple, and afterwards black like ink, on that admixture. A number of other vegetable ſubſtances will anſwer the ſame purpoſe, but not ſo certainly and readily as galls, where the ferrugineous matter is in very ſmall quantity.

The alcali that is in all theſe waters, is ſomewhat of the nature of the natrum of the ancients; being a native fixed alcali; it differs from the common alcalies, in that it is reducible to cryſtals like the natrum, and from that in no leſs eſſential a point than the figure of thoſe cryſtals. Both theſe ſalts have been, indeed, of a quadrangular form, but thoſe of the natrum are truncated at the ends; thoſe of the alcaline ſalt of the chalybeate waters terminate in pyramids in the manner of thoſe of nitre, and of the ſame number of ſides with the columns. This ſalt has all the properties and qualities of the common fixed alcaline ſalts produced from vegetables; mixed with acids, it efferveſces, and produces neutral ſalts; with an infuſion of violets, it turns green; with a ſolution of corroſive ſublimate, it precipitates a yellow powder from it; and, finally, with crude ſal armoniac, it produces an urinous ſmell.

It is of the utmoſt importance to the waters of this kind, they contain no other alcali, and yet there is no accounting for their properties rationally, without ſuppoſing one, nor any imitating them with tolerable ſucceſs without ſuch a ſalt. The common fixed alcali of tartar will, however, anſwer the purpoſe on theſe occaſions, and with that and a ſolution of the pyrites, or of iron by the help of an acid, a water may be prepared, greatly reſembling the natural chalybeate ones, even the fineſt not excepted; and by varying the proportions, the liquor may be brought to imitate not only the taſte, but the qualities of any chalybeate ſpring, whoſe waters a perſon would wiſh to drink, but cannot conveniently get at.

The ſalts, tinctures, and other chemical preparations of ſteel, contain the virtues of that metal as ſtrongly, or much more ſo, indeed, than the natural, or than theſe artificial waters; but there are many reaſons why the waters, eſpecially the native ones, are to be preferred to them. Both agree in the advantage of a copious quantity of liquid, ſwallowed with the medicinal matter; by which means, viſcid and tenacious humours, that cauſe the obſtructions they are often drank to remove, are much better diſſolved than they could be, even by a more powerful medicine with leſs fluid; and the native ones, in particular, have the advantage of containing the particles of this metal in ſo remarkably fine a ſtate, that they are even volatile, and not only are ſuſpended in the water, without altering its colour or pellucidity; but on that water's being expoſed to the air but a little while, they fly off and leave it vapid and inſipid, though before extremely ſpirited, and ſtrongly taſting of the iron.

They

They are of ſervice in all caſes in which chalybeates are proper, and even when there is not convenience of taking theſe, there is no way of giving chalybeates themſelves with ſo much effect, as by largely diluting them with water.

The mineral waters impregnated with ſalts are very various, according to the nature of the ſalts they contain. Some of them are impregnated with a ſalt of the marine kind, others with a fixed alcaline one of the natrum kind; theſe laſt are called nitrous, but very improperly; and others with an alcali and vitriolic acid, which, mixing together, form a ſalt of the nature of the factitious one invented by Glauber, and named from him. Theſe laſt are much the moſt common of all, but their origin is, in general, the leaſt underſtood.

The waters containing marine ſalt alone are no other than weak brine ſprings, the ſame, in their nature, with thoſe from which we, in many parts of England, prepare ſalt for the table, only that they have but a very ſmall portion of it. The ſea water itſelf comes under the claſs of theſe, but there is a great deal of difference in the taſte, qualities, and effects of this, from the waters of ſuch ſprings. They are impregnated ſolely with pure rock ſalt of the ſal-gem kind, without any admixture; but the ſea water contains, with this ſalt, another of the volatile alcaline kind, produced by the putrefaction of the bodies of dead fiſh in it, and always with this a portion of bitumen, to which it owes its bitterneſs.

Sea water, becauſe of this diſagreeable taſte, is rarely given internally, though, when people can be prevailed with to take it, great advantages are to be expected from it. It is of great uſe however in bathing; cutaneous eruptions of almoſt all kinds are cured by a conſtant uſe of it this way for ſome time; tumors and pains of the limbs are alſo often cured by it, and we find it continually recommended as the great medicine againſt the moſt terrible of all diſeaſes, the bite of a mad dog. It is a common error to ſuppoſe that water with ſalt diſſolved in it is the ſame thing with ſea-water. It is ſaid indeed, that it has anſwered in the external way, by way of bath, in ſome caſes; but thoſe people have been miſerably deceived who thought, from the internal uſe of ſalt-water ſome time ſince brought up among us, that they ſupplied its place in a pleaſanter manner by drinking common water with ſome ſea-ſalt diſſolved in it.

The medicinal waters, naturally impregnated with ſal-gem, purge by vellicating the inteſtines, and promote the diſcharge of urine; they are alſo diſcutient, drying, and aſtringent. They are recommended in dropſical and cachectic caſes, and often do great ſervice. They cleanſe foul ulcers, externally uſed, and diſpoſe them to heal, and by a long continued uſe have been known to do ſervice in paralytic complaints, and to œdematous tumors. There are a great number of theſe ſprings in France, and great benefit is received from them. The waters which contain an alcaline ſalt, and are improperly called nitrous ones, are cathartic and diuretic. It is evident the ſalt they contain is very different from our nitre, ſince, when ſeparated from them, as is eaſily done by evaporation, it is not of the taſte of nitre, but acrid and lixivial; and, when thrown on the fire, it does not deflagrate as nitre does. It is a true fixed alcaline ſalt of the nature of the natrum of the ancients, or ſope earth, as it is called, of Perſia. It affords the ſame quadrilateral truncated cryſtals on a careful evaporation after a ſecond ſolution, and, like that ſalt, has all the properties of the fixed alcalies fermenting with acids, turning ſyrup of violets green, and the like.

The waters impregnated with this ſalt, of which there are many in France and Germany, are excellent for the attenuating tough and viſcid humours, and removing obſtructions of the viſcera. They are alſo given in jaundices, in palſies, and in nephritic caſes with ſucceſs. It is however a general rule not to give theſe kind of diuretics, where the ſuppreſſion of the urine ariſes from a ſtone too large to be voided. For in this caſe, the afflux of a larger quantity of urine to the paſſages muſt be of great hurt, inſtead of good, to the patient. Externally theſe waters are uſed with ſucceſs in tumors and hard ſwellings, and in paralytic numbneſs.

The moſt common of all the waters impregnated with ſalt are the purging ones, which contain a ſalt of the compound kind, eaſily ſeparable from them by evaporation, and when ſeparated, found to be of the nature of Glauber's ſalt. Of this kind are many of the purging waters about London, and thoſe of many other parts of the kingdom. Yet, though theſe waters are of all the mineral kinds the moſt common, their nature and origin have been the leaſt underſtood. They have been ſuppoſed by many to contain only ſea ſalt, by others a nitrous, and by ſome, by a wilder gueſs than any of theſe, to be impregnated with a ſhining foſſile ſubſtance reſembling talc, and properly called ſelenites. There are uſually ſelenitæ of one kind or other met with in the ſtrata of clay, through which they dig to get theſe ſprings; and this, having ſomewhat of the external appearance of a ſalt, has been ſuppoſed to impregnate them; but this is ſo contrary to reaſon, that no one acquainted with the mineral kingdom can give any ſort of credit to it; the ſelenitæ are not ſoluble in water, and, if they were, they muſt give the water they were received into an aſtringent, not a cathartic virtue. They are all manifeſt aſtringents, and one of them in particular, of the rhomboidal kind, is called by the people of ſome of our counties, where frequent, ſtaunch, from its known virtue of ſtopping hæmorrhages.

The ſalt which impregnates theſe waters is of a compound kind; it wants a name at preſent, but is the very ſame ſalt with that made by art, and called from its inventor Glauber's ſalt. On looking into the proceſs of making Glauber's ſalt, one would not think it, at firſt ſight, the reſult of a combination likely to be made by nature in the bowels of the earth; yet nothing is more certain than that theſe waters all contain a ſalt of the ſame kind with this of Glauber, and that the ſame ſalt is not only found in this ſtate of ſolution, but even in a ſolid form in the earth; and that not only in England, but in almoſt every other part of the world.

The clay pits about London, and many other places, near which there are purging mineral waters, abound with a kind of nodules or maſſes of clay, of a different colour from that of the ſtratum, uſually paler and yellower; they are commonly of the bigneſs of a hen's egg or thereabouts, ſometimes flat, ſometimes roundiſh, and more uſually oblong. They have always ſomething of the pyritic kind in their center, very frequently a regular cruſtated ferrugineous body, with a great deal of the matter of the common pyrites in ſome of their cruſts; and they are often ſpangled on the ſurface with a number of ſmall glittering ſelenitæ. Theſe nodules, after they have been ſome time expoſed to the air, frequently contain a large quantity of a native ſalt of this kind; they never have any of it, when firſt dug up; and many of them afterwards have ſo little, that it requires ſome addreſs and management to diſcover it; but others of them contain ſo much that it is very evident to the taſte, and eaſily ſeparated into fair cryſtals; to have them in this ſtate, however, a proper period is to be watched; it does not happen till they have lain a long time expoſed to the air, and, ſoon after they arrive at it, they moulder to pieces and are loſt.

Accident diſcovered the ſalt to me, ſays our author, in one of theſe nodules collected at the lucky period. I had, continues he, thrown it into a baſon of water, with no other intent than to ſeparate the little ſelenites it contained without injuring their figure, when, after a day or two's ſtanding, the ſides of the baſon were incruſtated round with ſome cryſtals, whoſe figure and taſte declared them to be the ſame with Glauber's ſalts; in examining other of the nodules, ſome of them were found covered in certain parts with white efflorеſcences, which were bitter and cold in the mouth, and were evidently the ſame ſalt, firſt ſeparated, and compared with Glauber's ſalt. A quantity of this ſalt, afterwards ſeparated from a number of theſe nodules, formed itſelf pretty regularly into the true figure of Glauber's ſalt, and anſwered all its characters on the ſtricteſt examination. It is bitter and cold to the taſte like it; it diſſolves as readily in cold water as common Glauber's ſalt, and requires the ſame quantity of water to diſſolve it; and, like that ſalt, loſes

two thirds of its weight in calcination. Its calx mixed with three times its weight of water coagulates it into a ſort of ice; it diſſolves iron, and precipitates it in a fine reddiſh crocus, as it diſſolves it; it calcines in the air and ſun, juſt as the Glauber's ſalt does; it eaſily melts in the ſame manner on burning charcoal without taking fire, and burns to a ſaline calx; and it precipitates mercury diſſolved in ſpirit of nitre into a yellow precipitate or turbith. Theſe experiments leave not the leaſt room to doubt its being the very ſame ſalt with that procured by chemiſtry according to Glauber's method; nor is this the only inſtance, in which ſuch a ſalt has been found.

The French academicians received from Grenoble in Dauphiny, ſo long ſince as the year 1727, a ſaline earth full of glittering ſpangles; which, on accurate examination made by Monſ. Bolduc, was proved to contain a true Glauber's ſalt. The mention of ſpangles in this earth ſo well agreed with the ſelenites formed uſually in that which contains this ſalt with us, that it was eaſy to ſuſpect they were the ſame. When the hint of a native ſalt was thus given among the French, they ſet on foot enquiries after it in other places, and it has accordingly been diſcovered in ſome other parts of their dominions; and in Spain, Hungary, and even in Egypt, where M. de Mars found it in the year 1732. In many of theſe places it does not wait the effects of expoſure to the air, in order to form or diſcloſe itſelf, but is formed, at different depths in the earth, as perfect as on the ſurface; and in all probability it is in the ſame manner lodged perfect in the ſtrata in ſome places with us, though the diſcovery of it is at preſent ſo new that there has been no opportunity to carry the ſearches farther. In effect, it is to this ſalt, ſometimes pure, ſometimes diſguiſed by admixtures of other ſalts, that moſt of the purging waters of Europe owe their virtue. In France, there have lately been diſcovered ſome waters impregnated with this ſalt only: in Spain it is found only in water, never in a ſolid form, or lodged in earth; but, when ſeparated from the waters of the ſprings that contain it, it is entirely the ſame with this ſalt of ours, and of the French, and with the Glauber's ſalt of the ſhops. We have the experiments made by M. Bolduc on the ſalt thus ſeparated from the Spaniſh waters, and from the ſal Glauberi of the ſhops; to prove that they are abſolutely the ſame, he gives us ſeveral proceſſes on metalline ſubjects with them, and the operation of both is the ſame in all reſpects, and is plainly that of a vitriolic acid.

When we examine the proceſs for making the factitious ſalt of Glauber, we find it is the reſult of the combination of the vitriolic acid with the alcaline matter which is the baſis of common ſalt; and, when we underſtand ſo much of it, it will not be difficult to allow that it is a proceſs that may be performed, and a combination that may be made in the earth. We find that Stahl's weaker acid of ſea-ſalt will give place to the ſtronger acid of oil of vitriol on mixture, and, yielding up its baſis to this new one, there is a new ſalt produced, and this without any chemical apparatus, or the very aſſiſtance of fire; the acid of one ſalt may then eaſily combine with the baſis of another. The baſis of a ſea ſalt is a harſh earth ſo extremely attenuated as to approach to the nature of an alcaline ſalt. This earth is in all the foſſile muriatic ſalt ſcattered throughout the earth, and this foſſile ſalt is preſent in many places, as may be proved by experiments made with that nice teſt a ſolution of ſilver, where it is not at all ſuſpected, as not being in quantity enough together to be diſtinguiſhable to the taſte; but, beſide this ſalt, the earth which is in its baſis may be alſo looſe and ſeparate in diſſeminated particles in many earths where we have no idea of it, but where the vitriolic acid finding it out may combine with it, and form a ſalt like what is here deſcribed. That the vitriolic acid abounds in the earth is evident beyond all diſpute, and that theſe do meet and combine is as certain from this ſalt, which can be the reſult only of ſuch a combination, as it is from reaſon that they may.

In the caſe of our Engliſh ſaline nodules, the manner of their becoming impregnated with this ſalt ſhews evidently that the alcaline baſis of ſea-ſalt is contained in the clay, and is ready to receive the vitriolic acid, whenever it offers; theſe nodules contain the matter of the pyrites within them, which, while in the earth, like the pyrites in all other forms, while buried, diſcloſes nothing of its vitriolic acid, and therefore cannot act upon the alcali in the cruſt; but no ſooner has it been expoſed to, and penetrated by the air, than vitriol is formed, and its acid mixing with the baſis of alcaline matter in the cruſt affords us this ſingular ſalt. As theſe nodules contain none of this ſalt till they have lain a while expoſed to the air, it is impoſſible they ſhould impregnate the waters that paſs through the ſtrata where they lie, and make them cathartic; but in all probability there is more of this alcaline matter in the ſtrata, which, meeting with the vitriolic acid ready formed in the earth, furniſhes the purging ſalt which is the reſult of their mixture in abundance, and impregnates with it all the water that paſſes by.

It is evident, that there does need ſea ſalt for the formation of Glauber's ſalt; the baſis of that ſalt is ſufficient, and is what our new found ſalt is formed of. Our ſalt, or that of Glauber, will either of them make a hepar ſulphuris with charcoal; and the baſis of our ſalt ſeparated by this proceſs, and examined in the niceſt manner, and by the moſt critical experiments, proves to be entirely the ſame with that of Glauber's ſalt, and both the ſame with the baſis of ſea ſalt. Mixed with ſpirit of nitre, it produces the quadrangular nitre; with ſpirit of ſalt it affords a true regenerated ſea ſalt, which is the ſtrongeſt of all proofs that it is abſolutely the ſame ſubſtance that is the baſis of ſea ſalt, and mixed with oil of vitriol it produces a true and genuine ſea ſalt again.

There is not in the world a ſalt more ſingular in its nature and its effects in mixture than Glauber's ſalt, or that has more incommunicable properties. The mixture it is liable to, when formed in a ſtate of ſolution in the purging waters, renders ſuch as is ſeparated from them leſs fit for the nicer experiments; but that which is ſeparated by ſolution from theſe nodules will never fail to anſwer in every particular to the utmoſt nicety.

The waters impregnated with this ſalt purge gently, and without pain or irritation, and are excellent in all diſorders ariſing from a *viſcid phlegm*, which they attenuate and carry off; they reſtore a decayed appetite by perfectly cleanſing the ſtomach, when oppreſſed with a load of this phlegm, and are good in all diſorders ariſing from obſtructions of the viſcera. The ſulphureous mineral waters are diſtinguiſhed from all others by their ſmell being like that of lime or of ſulphur, though very different in degree; many of them alſo incruſt with abſolute ſulphur the paſſages through which they run, and the reſt, when evaporated to a dryneſs, always afford a reſiduum, which proves to be ſulphureous on chemical trials, and indeed diſcovers itſelf ſufficiently and obviouſly on throwing it on burning coals, for it burns there with a blue flame, and a ſmell that no body can be miſtaken in. The ſulphur with which theſe incruſt the paſſages they run through, is extremely like the fineſt flour of brimſtone; it is of a pale yellow colour, and very ſulphureous ſmell. It is collected on the ſpot, and is much eſteemed, in ſome places, for medicinal uſe; but, as to its excellency that way, it is not eaſy to conceive that it can be greater than that of flour of brimſtone truly prepared.

The waters thus impregnated are drank in aſthma's, and other diſeaſes of the breaſt, and in caſes of cutaneous foulneſſes of all kinds, in which they have great ſucceſs. They are alſo uſed as baths on ſome occaſions, and for trembling contractions, or paralytic numbneſſes of the limbs, and for the rickets in children.

The virtues of ſulphur may be communicated to water, and it may be made to imitate that of the natural ſulphureous ſprings, by burning and quenching ſulphur vivum in it ſeveral times; but it becomes a very diſagreeable liquor by this means. The mineral waters impregnated only with terrene or earthy particles are of an in-

ferior claſs to all the others; there are ſeveral of them in Germany, Italy, and Lorrain; they contain a fine, white, light earth, which is much the ſame in all of them, and is no other than the lac lunæ of the modern authors, or creta ſeleneuſiaca of the ancients; this is ſuſtained in ſuch imperceptible particles in them, as they came out of the ſpring, that they are perfectly clear; but they do not carry it far, but depoſit it about the bottom and ſides of their channels, as they run off.

They are drank againſt hæmorrhages, habitual diarrhœa's, dyſenteries, and diabetes, and in all caſes where a ſoft alcaline abſorbent and aſtringent can be of uſe; but, in general, the taking the earth they depoſit, or any other ſoft alcaline aſtringent earth in its place, would anſwer the ſame purpoſe, and in many of the caſes would ſucceed better alone than with that load of water it is joined with in this ſtate.

Uſes of WATER *in vegetation.*—Water is abſolutely neceſſary to the growth of vegetables, and experience hath long evinced the great advantages ariſing from the overflowing of paſtures. It is however but of late years that this very profitable improvement is become pretty general in England; nor is it, as Mr. Worlidge obſerves, yet carried to near the perfection it might be advanced to, if the following obſtructions were removed.

1. The ſeveral intereſts that are in lands bordering on rivers, hinder very much this improvement, becauſe the water cannot be brought over ſeveral quantities of land ſo circumſtanced, but through the ground of ignorant and croſs neighbours, who will not conſent thereunto, though for their own advantage alſo, under unreaſonable terms; and ſome will not at all. Others, again, are not, by law, capacitated for ſuch conſent.

2. A great and pernicious impediment to this improvement is the mills that ſtand on many fruitful ſtreams; prohibiting the laborious and ingenious huſbandman to receive the benefit and advantage of ſuch ſtreams and rivers, which carry in their bowels much wealth into the ocean, while the mills themſelves yield not a tenth of the profit to the owners, that they hinder to their neighbours, and their work may be as well performed by the wind, as by the water.

3. Another grand impediment is the ignorance of the countrymen, who are commonly poſſeſſed with a fooliſh opinion, that the water leaves all its fatneſs on the ground it firſt flows over, and therefore will not benefit the next; which is moſt untrue; for meadows have been ſeen ſucceſſively drowned with the ſame water, to almoſt an equal improvement for many miles together. It is true, the water leaves behind it a great part of the fatneſs which it hath waſhed from the hills and high-ways in the time of great rains: but we find by daily experience, that meadows are fertilized by overflowing, as well in clear and dry weather, as in rainy, and that to a very conſiderable degree. The cleareſt and moſt tranſparent ſtreams will improve even ordinary lands, ſo much as to render them very fertile meadows.

4. From a greedy and covetous principle, the graſs is ſuffered to ſtand ſo long on the watered meadows, that it becomes much diſcoloured, grows haulmy, and is neither ſo toothſome nor ſo wholeſome, as that of unwatered meadows.

5. The former of theſe impediments might eaſily be removed by a law, which would be of very great advantage to the kingdom in general. The latter can be remedied only by the example of ſuch induſtrious and worthy perſons as underſtand better things: the generality of the world being rather induced to an ingenious and profitable enterprize by example, than by precept: although ſome are ſo ſordid and ſelf-willed, that neither apparent demonſtration, nor any convincing argument whatſoever, can divert them from their bias of ill huſbandry.

The induſtrious Swiſs, ſenſibly attentive to every means of benefiting their deſervedly cheriſhed country, have thought this branch of huſbandry of ſufficient importance to propoſe it for the firſt premium offered by their truly laudable Society at Berne, for the year 1760: and to them we are indebted to the diſſertations produced thereby, for ſeveral of the following remarks.

Water not only acts as a vehicle to the nouriſhment of plants, but alſo carries with it many particles which enrich the ſoil; eſpecially after heavy rains. It then depoſits a fertilizing ſediment, which turns the mould to a blackiſh colour. The common ſaying, that watering makes the ſtones diſappear, is true; not ſo much from their ſinking into the earth, as from their being covered by the new ſupply of mould brought by the ſlimy muddy water, particularly after great rains. Watering likewiſe promotes the putrefaction of every vegetable and animal ſubſtance found in the earth, and thereby contributes greatly to meliorate the ſoil underneath the ſward.

Plants which grow on dry paſtures contain richer and more nouriſhing juices, than thoſe which grow in moiſt places. Care ſhould therefore be taken, that the quantity of moiſture brought upon the paſture, be only ſuch as ſhall give vigour to the plants, without over-charging their veſſels. In order to do this, every part of the paſture ſhould be watered equally, and as little water as poſſible ſhould be ſuffered to go where the land is naturally moiſt.

Extreme heat ſhould alſo be avoided in watering; becauſe heat draws the moiſture too haſtily up into the plant, which is thereby filled with a watery juice, and rendered of ſo tender a texture, as eaſily to be killed afterwards by drought or cold.

If the ſpring proves dry, paſtures may be watered as ſoon as the froſty ſeaſon is over; and this may be continued till the graſs begins to ſhoot. But if the winter has been ſevere, and the earth remains moiſt, no current of water ſhould be admitted, till the earth looſened by the froſt is ſettled, and the ſurface become pretty dry: for even the gentleſt ſtream would carry off the fine mould looſened by the froſt. After that the graſs has begun to ſhoot, and the weather is become mild, the water ſhould be adminiſtered more ſparingly; that is to ſay, in ſuch proportion only, as juſt to puſh the graſs gently on, till it has made ſuch a covering as can ſhelter the earth from the too great power of drying winds, or of a ſcorching ſun. Watering ſhould afterwards be uſed with great caution, and only in caſe of extreme drought; nor even then, unleſs the water be perfectly clear and ſweet, leſt it ſhould foul the graſs, or give it a bad taſte. If it be admitted ſparingly before the hay is cut, it will make the graſs ſtand the better to the ſcythe.

For a little time after the hay is made, the water ſhould be admitted only in the night: becauſe the weather then generally is very warm; for it is obſerved, that rain which falls with a hot ſun, or a hot ſun that comes on a heavy dew, is prejudicial to plants. Watering, under the ſame circumſtances, will have the ſame effect, to prevent which the prudent huſbandman will let in his water only in the evening, and will withdraw it again before the ſun gets up. It is continued at this ſeaſon only till the graſs begins to ſhoot vigorouſly; and in caſe of very great drought it may be repeated, but very ſparingly.

If a ſecond crop of hay is made, the water may be uſed more freely; as the weather is then become cooler, and the earth is generally very dry. This flooding will bring up a plentiful after-math. If the ſecond crop of graſs is fed off, the watering ſhould be renewed in the ſame manner: only care ſhould be taken not to ſuffer cattle to feed on the ground while the water is upon it, becauſe their poaching would deſtroy the roots of much of the graſs, and leave the ſurface uneven; which ſhould be avoided in a paſture.

The latter end of autumn is the ſeaſon in which watering is the longeſt continued: and conſidering the dryneſs and parched ſtate of the earth at that time, this practice ſeems rational: for the water then, not only ſupplies the moiſture wanted in the earth, but it diſſolves every ſubſtance ſoluble in water, and thereby converts to an additional manure, what might otherwiſe have remained long in its original ſtate. Care ſhould, however, be taken, to drain off the water before the ſeaſon of ſtrong froſts is expected; becauſe froſt is obſerved to deſtroy all kinds of vegetables much more when the plants are full of ſap, than when they are in a dryer ſtate. We

may eaſily comprehend that it muſt have this effect, when we conſider with what force it breaks every veſſel containing water expoſed ſo as to be frozen: for froſt dilates all fluids to ſuch a degree, that the veſſels in which they are muſt be broken thereby. Hence it is that ſucculent plants ſoon become a putrid maſs after a hard froſt: and thus it is that the ſtrongeſt trees are ſometimes burſt with a loud report.

When the water is brought to the deſired height, the main channel ſhould be cut, with ſuch a deſcent as only juſt to keep the water in a gentle motion. That channel ſhould be made in the higheſt part of the paſture, and proportioned to the quantity of water neceſſary to be introduced. If a hollow intervenes between the place at which the water is brought into the field, and another riſing ground in that field; it will be worth the farmer's while to convey it a-croſs that hollow, by pipes made of wood, or any other ſubſtance, laid either horizontally over that hollow, or underneath it. The motion of the water in this horizontal channel ſhould be different, according to the quality of the ground. If it is a ſtrong earth, the channel may be cut nearly horizontally: but if it is a light looſe ſoil, a quicker current ſhould be given to the water, in proportion to the degree of lightneſs of the earth; or great part of the water will otherwiſe be loſt, by ſinking into it. In a light ſoil of this kind, it may be proper to line this main channel with brick or ſtone, well cemented with lime, to hinder the water from eſcaping through the crevices; or at leaſt to cover it with clay well rammed. As to the degree of deſcent moſt proper for the main channel, in order to give a current to the water, M. Bertrand, to whom we owe one of the ingenious diſſertations on this ſubject in the Memoirs of the Berne Society, obſerves, that Vitruvius required ſix inches in an hundred feet, which is a great deal too much: but that the moderns, who have made the moſt exact experiments in this reſpect, are ſatisfied with two inches in ſix hundred feet, when they cannot have more, and recommend particularly the avoiding of all ſharp angles in the winding of the channel, and the making of its bottom quite ſmooth and even. He adds, that this is nearly the declivity of the aqueduct of Rocquancourt, by which the water is conveyed to Verſailles; the diſtance there being three thouſand four hundred yards, and the ſlope, in all, only three feet.

The main channel ſhould be of breadth, rather than depth, ſufficient to receive all the water that is intended to be conveyed through it, and that breadth ſhould leſſen gradually as the water is carried off in leſſer channels, in order that the water may preſs into thoſe ſmaller ducts, which are to iſſue all along from the chief. The leſſer channels ſhould be as ſhallow, and as numerous, as can be: for the more equally the water is diſtributed over the graſs, the greater will be the improvement. They ſhould be made particularly wherever the water collects itſelf into a ſtream: for though cutting ſo much turf may ſeem to waſte a great deal of land, yet it proves not ſo in the end; becauſe the quicker the water runs over the graſs, the more it benefits the paſture.

To keep the channels in repair, they ſhould be frequently cleaned, eſpecially after every cutting of the hay. The ſlime then taken out of them ſhould be ſpread upon the paſture, and the next growth of the graſs will be greatly improved thereby. Care ſhould alſo be taken to have drains to carry off the water, ſo that none of it may ſtagnate upon the land.

The beſt way of watering a flat meadow, which is uſually ſurrounded with a ditch, is to ſtop the out-let of the ditch, and, by bringing in a quantity of water, to overflow the whole meadow, for ſuch time as ſhall be judged neceſſary to moiſten the earth ſufficiently; but the water ſhould not be continued upon it ſo long as to wither the graſs. If this can be done in a rainy ſeaſon, it will be ſo much the better; becauſe the water will then be loaded with the enriching mud and ſlime waſhed down from the higher grounds.

The firſt heavy rains which fall in the latter end of the autumn, and which carry with them the rich particles of putrified animals and plants, are thought to be more fertilizing than at any other ſeaſon of the year, and are therefore brought into the paſture, as often as the abſence of the cattle fed on them will permit.

The next beſt to rain, is clear and ſweet ſpring water, flowing from a copious ſource. Here it is generally objected, that ſpring water is hard, and therefore not fit for the nouriſhment of plants. But Dr. Home, who judges otherwiſe, expreſſes himſelf thus on this very occaſion. "Is not hard water more nouriſhing for vegetables than ſoft water? I imagine that the ſalt of vegetables enters their veſſels in ſuch a form as hath the ſalt which is found in hard waters. The ſalt of hard waters ſeems likewiſe to be of the nitrous kind, of which the nouriſhment of plants is alſo ſuppoſed to be. This query thwarts the general opinion; for no gardener will make uſe of hard water, if he can avoid it. I watered ſome plants with it, and thought that they grew better than thoſe which were watered with ſoft water."

This is confirmed by an ingenious correſpondent of the Berne Society, who made ſeveral experiments on the qualities of different waters, and found that their greater or leſs hardneſs made very little difference in their effects, when uſed for watering of paſtures. The water of an excellent ſpring, which, upon trial, was found to be hard, fertilized greatly the paſture upon which it was let in.

Spring water may be uſed later in the winter, than any other, becauſe, being warm, a mild froſt will not freeze it, even when expanded on the paſture. It ſhould however be turned off ſoon enough to let the earth become a little dry before ſevere froſts ſet in. It may likewiſe be uſed earlier in the ſpring, than other waters, and to better advantage, by reaſon of the warmth which it communicates to the ground where it flows: and it becomes extremely proper in the ſummer, becauſe it cools during the night, the only time for watering at that ſeaſon, the heated ſoil, and graſs ſcorched by the power of the ſun.

The equal warmth of ſpring-water, is what renders it peculiarly uſeful for watering paſtures. The laſt quoted correſpondent of the Berne Society tried its heat, in Swiſſerland, on the twenty-ſixth of May, when the earth had been very little warmed by the ſun, after a long winter's cold. He then found M. de Reaumur's thermometer, placed in the ſpring of water, ſtand at eight degrees and a half, equal to forty-ſeven and a half of Farenheit's, above the freezing point. On the fifth of July, in the evening, when the heat of the air was very great, Reaumur's thermometer, again placed in the ſpring, ſtood at nine degrees and a quarter, equal to forty-nine of Farenheit. He afterwards tried whether the warmth of the ſpring was conſiderably increaſed towards the end of the ſummer, when the earth was extremely heated: but even then, Reaumur's thermometer ſcarcely reached ten degrees, equal to about fifty of Farenheit's. By this we ſee, that ſprings which yield a full and conſtant ſtream vary very little in their degrees of warmth.

For the ſame reaſon it alſo is, that a perpetual verdure reigns around ſuch ſprings, even during the hardeſt froſt; and if their water could be preſerved from freezing when ſpread over a field during the winter, it would be right to let them in upon paſtures in that ſeaſon: but as they ſoon loſe their heat when diſperſed over the graſs, this is by no means adviſable.

Experience has taught the inhabitants of the Alps, and the ſame will hold equally true in all mountainous countries, that it is not adviſeable to water paſtures with the floods which ariſe from melted ſnow, or with the water of rivers fed thereby. One reaſon which ſeems to render the water that deſcends from mountains perpetually covered with ſnow the leſs uſeful for watering paſtures, is, that as all vegetation is at a ſtand in ſuch places, no vegetable matter can be mixed with this water; and it therefore cannot communicate the fertility which ariſes from waters fraught with thoſe rich ſubſtances.

We are frequently told of correcting the crudity of water, by making it turn a wheel, or putting it otherwiſe into violent motion; but we know not what good effect this can have.

What are commonly called barren ſprings, are ſometimes corrected by mixing dung with their water in ponds made higher than the paſture intended to be watered. Yet this, though an old cuſtom, is liable to ſome objections; one of which, in particular, is that the water will depoſit its richneſs on the firſt part of the paſture over which it flows, and therefore improve the graſs very unequally. But if dung has this effect, it will anſwer equally well, if it be ſpread upon the land. Care ſhould, indeed, be taken, that the current of the water be very ſlow over a paſture newly dunged; becauſe the fertilizing particles of the dung may otherwiſe be carried off by the ſtream, before they can have had time to penetrate into the earth.

When dung, marl, or lime, is laid on a paſture which has a conſiderable deſcent, the beſt way is to lay a larger proportion on the higher parts; becauſe the common rain water will waſh ſome of their richer particles down to the lower.

As clayey ſoils retain water, and by that means chill the plants growing on them, they are the leaſt fit for watering of any. If the water continues on them, they become poachy; and when dried again, they gape, and become ſo hard that no plant can pierce them. Some ſenſible farmers have likewiſe obſerved, that their clayey lands have always yielded leſs graſs in wet years, than when the ſeaſon has been dry; which is a manifeſt proof that a ſoil of this kind does not admit of watering, unleſs it be a little, in caſe its ſurface is become hard after the hay has been taken off, or when the graſs is ſhort. Such lands are fitter for arable, if their ſituation permits it.

Hazel earth, which is a loam mixed with gravel, and of a clayey nature, is the ſtrongeſt ſoil that can be watered, with propriety: and that this has been ſurpriſingly benefited thereby, is evident from ſeveral inſtances given in the Memoirs of the Berne ſociety, even of large tracts of ſuch ground that have been vaſtly improved by this means: but we ſhall mention here only the following.

In the ſummer of 1758, part of the paſture ground belonging to a farmer in Swiſſerland was ſo entirely covered with ſtones and gravel, by the ſudden overflowing of a ſtream, that it appeared like a bank of ſand. As the removing of this quantity of ſtones and gravel would have coſt a great deal of labour and expence, the owner of the land carried off only the largeſt ſtones, and threw over the gravel a reddiſh earth taken from a neighbouring hill; but ſo thinly ſpread, as only to fill the interſtices between the pebbles, without entirely covering them. He then ſowed this ſpot with hay-ſeeds, and let in upon it the waters of an adjacent ſpring and a neighbouring rivulet. Theſe waters were let in ſparingly at firſt, till the graſs began to appear, and after that they were flowed more abundantly. The conſequence of this prudent conduct was, that the graſs thus raiſed bore cutting once the firſt year, and after having been mowed twice in the ſecond, promiſed an excellent after-math at the time when this account was written, which was in the beginning of the autumn of that ſecond year. The very firſt year's crop grew ſo prodigiouſly, that the graſs was lodged, even though the pebbles were then felt under foot, if one trod upon it.

Methods of conveying away WATER, *when it abounds too much and hinders vegetation.*—Before we conſider what methods are moſt proper for conveying away water, it is neceſſary to inquire what are the things that occaſion our being troubled with too much of it in our fields. For if the cauſes of the diſeaſe are known, it will be the more eaſy to apply the remedy.

Sometimes land is wet from its ſituation; is expoſed to overflowings from higher ground, and has no proper deſcent to allow the water to run off. When a great quantity of rain falls, it ſoon makes its way from the heights into the hollows, and there lodges, till it is exhaled.

Sometimes the bottom of land is of ſuch a nature, as to force out in ſprings, the water that runs below the ſurface. Water runs in channels below ground. Sometimes it ſprings out, becauſe theſe channels, in which it runs, reach the ſurface; and ſometimes, becauſe it meets with an interruption in its courſe, which makes it force its way upward, and break out. When water falls upon land that eaſily admits it, it makes its way downward, till it is reſiſted by a bed of till, clay, or rock. If this bed has a declivity, as is commonly the caſe, the water falls along the declivity. If in any place this bed reaches the ſurface, or if the water meets with any interruption, there it breaks out; or if the ground riſes, and the bed riſes along with it, then the water breaks out in the hollow.

Sometimes the wetneſs of land is occaſioned by the ſeaſon, or climate, in which the rain is violent, and ſo frequent, that no time is allowed the land to dry. And

Sometimes all theſe things may concur to render land wet.

The wetneſs of land from its ſituation may be prevented. The water, as it falls from the higher ground, may be received into drains, and, by theſe drains, conveyed away; and thus prevented from overflowing the land below. For although the land may be ſo low ſituated, as to render it difficult to convey away the water that falls upon it; yet the water may be intercepted, in running from the higher ground, before it reaches the hollow by a drain, at a place where there may be a ſufficient fall. If the higher ground is in tillage, the ridges and drains of it may be placed in ſuch a manner, as to prevent the water from coming down from it with violence; or the water may be directed, in its courſe, to channels where it can do little harm.

The wetneſs of land from the nature of its bottom, may likewiſe, in ſome meaſure, be prevented by drains. Land wet from the breaking out of ſprings, is generally upon a declivity. If the water runs near the ſurface, before it breaks out, it may be intercepted by a drain drawn acroſs the declivity, a little above the place where it firſt makes its appearance. And, if the channel lies deep, it may be prevented from running over the land below by a drain, drawn acroſs exactly where it ſprings up. In ſome caſes, it may be known, whether the channel of the water is near the ſurface, or lies deep. If the land is dry immediately above the place where the water ſprings out, it is an evidence that the channel of the water lies deep: if, on the contrary, the land is wet, even at ſome diſtance above the place where the water ſprings out, it is a preſumption, that the channel of the water is near the ſurface. It would be a certain evidence of it, if there were no more ſprings but one. But if there are ſeveral ſprings, ariſing from water running in different channels, the land above the principal ſpring may be wet, not becauſe the channel of the water of this ſpring is near the ſurface, but by the breaking out of other leſſer ſprings, the channels of whoſe waters reach the ſurface, before that of the waters of the larger ſpring.

The wetneſs of land, ariſing from the climate or ſeaſon, is not to be prevented in the ſame manner, as that which ariſes from the other two cauſes mentioned. When land is wet, either from the over-flowings of higher ground, or from ſprings, the water, by drains, may be intercepted; and thus prevented from doing harm. But when the wetneſs ariſes from the climate, or a ſeaſon in which there is too much rain, as is often the caſe, it cannot be made dry by intercepting the water. In this caſe, we can only remove obſtructions, and thereby allow it, as quickly as poſſible, to run away. Caſting drains in places of the field where the water is in danger of ſtagnating, will be of ſome uſe; but this cannot anſwer the end; for thereby no more is done than conveying away the water, that would ſtagnate in the hollow; while nothing is done to convey it from the reſt of the field. And therefore, to drain land in this ſituation, it is neceſſary to lay it up in ridges properly placed, and to cut ſmall drains acroſs the ridges, where neceſſary, communicating with each other, and with the furrows. For, by this method, all the furrows betwixt the ridges become drains. The water, as it falls upon the ridge, immediately makes its way to the furrows, and along them where there is any deſcent; and, if it is ſtopped in any of them by the ground riſing, is conveyed by the

Fig.1.

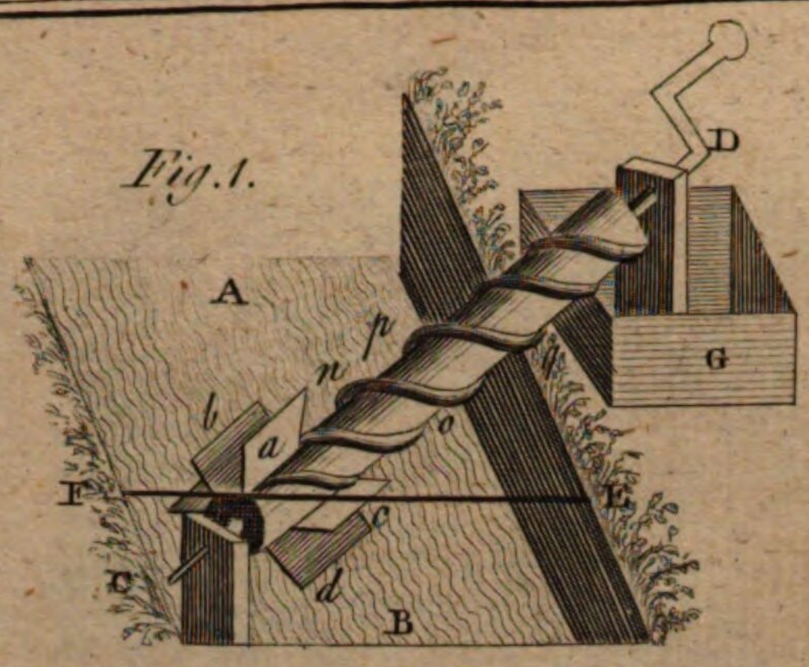


Fig.3.

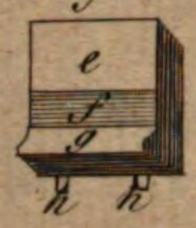


Fig.4.

Fig.2.

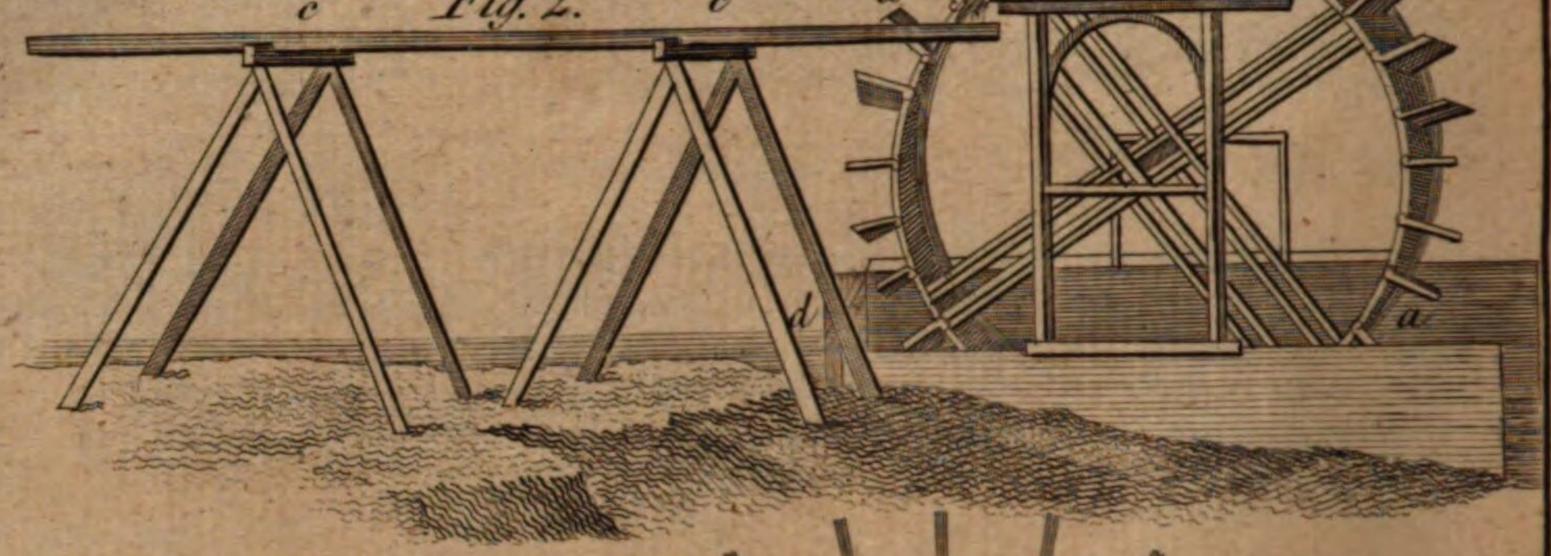


Fig.5.

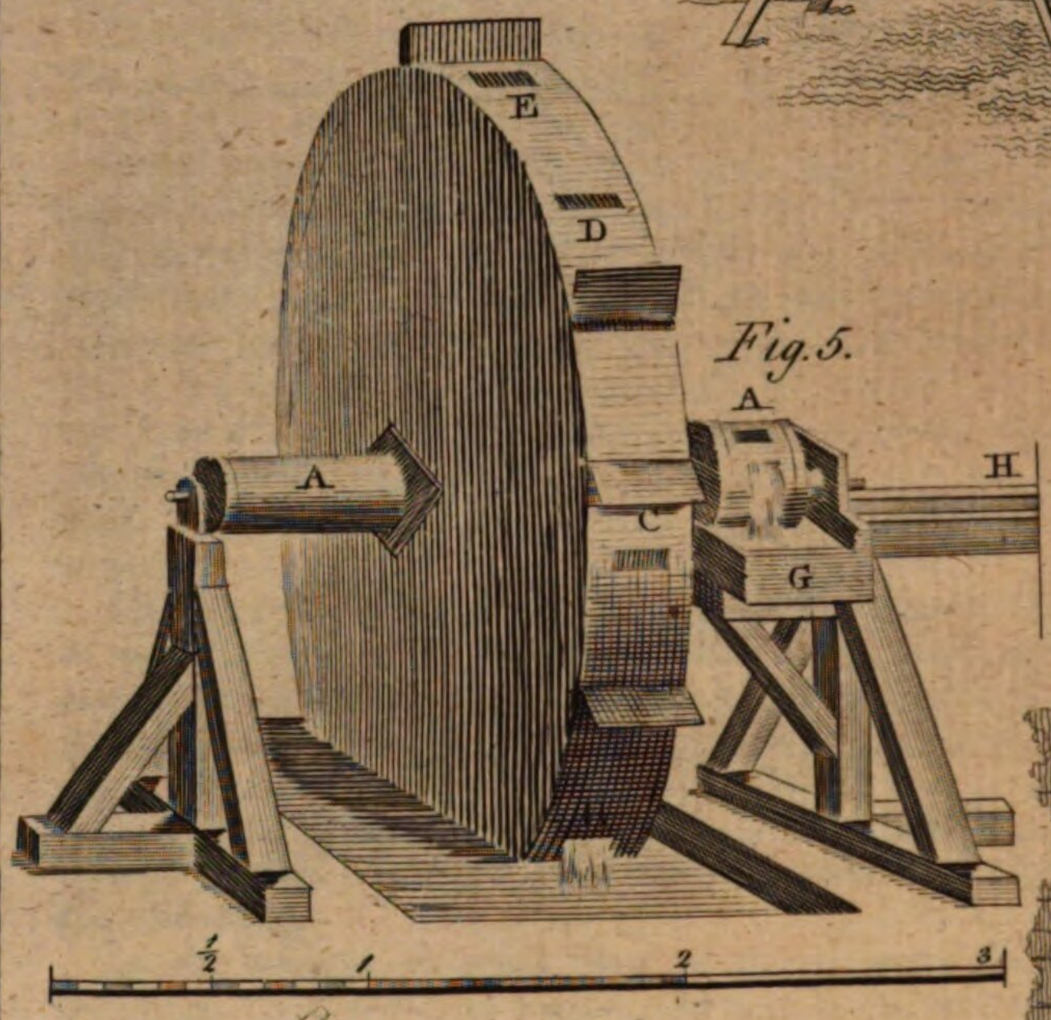
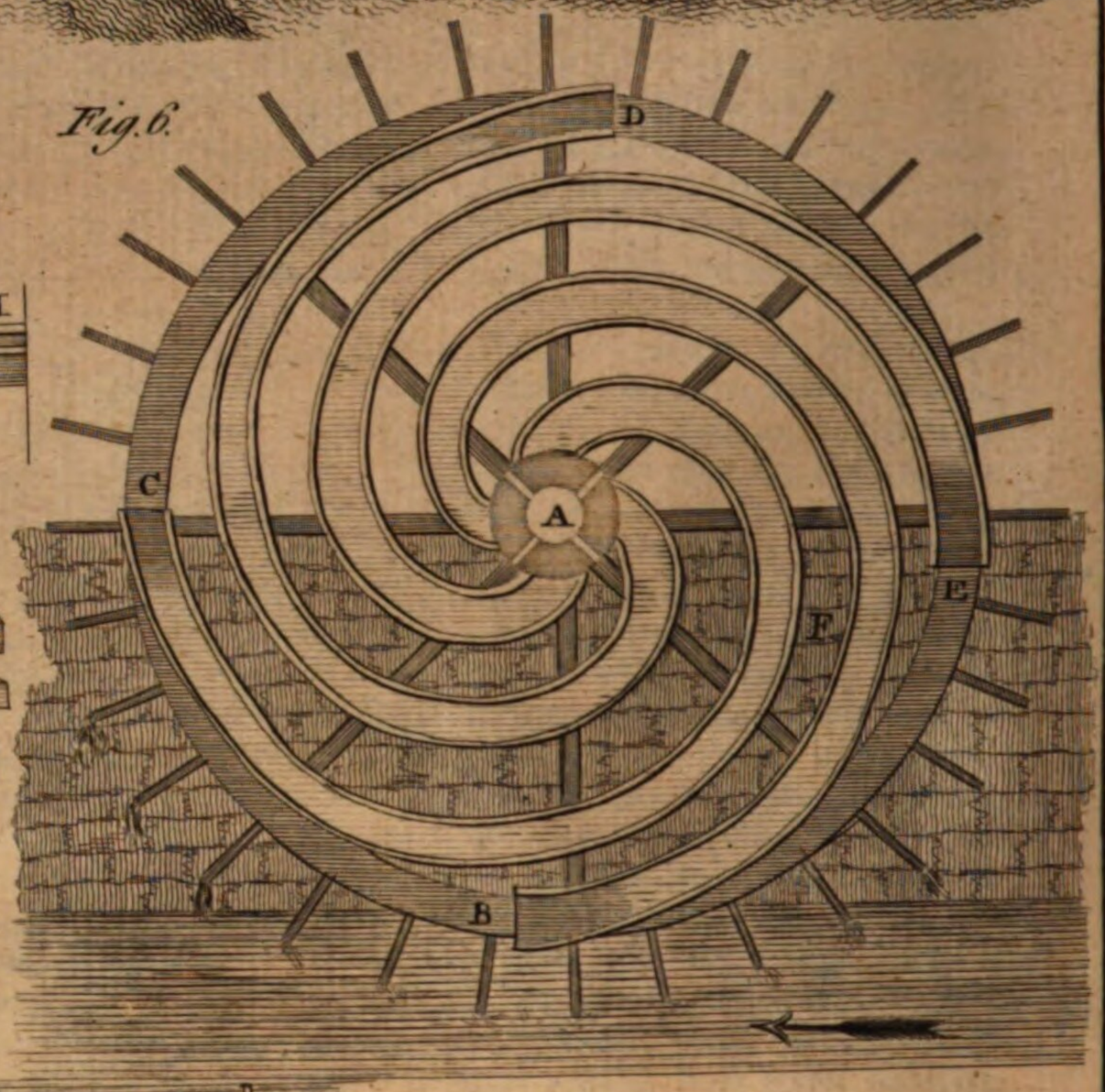


Fig.6.



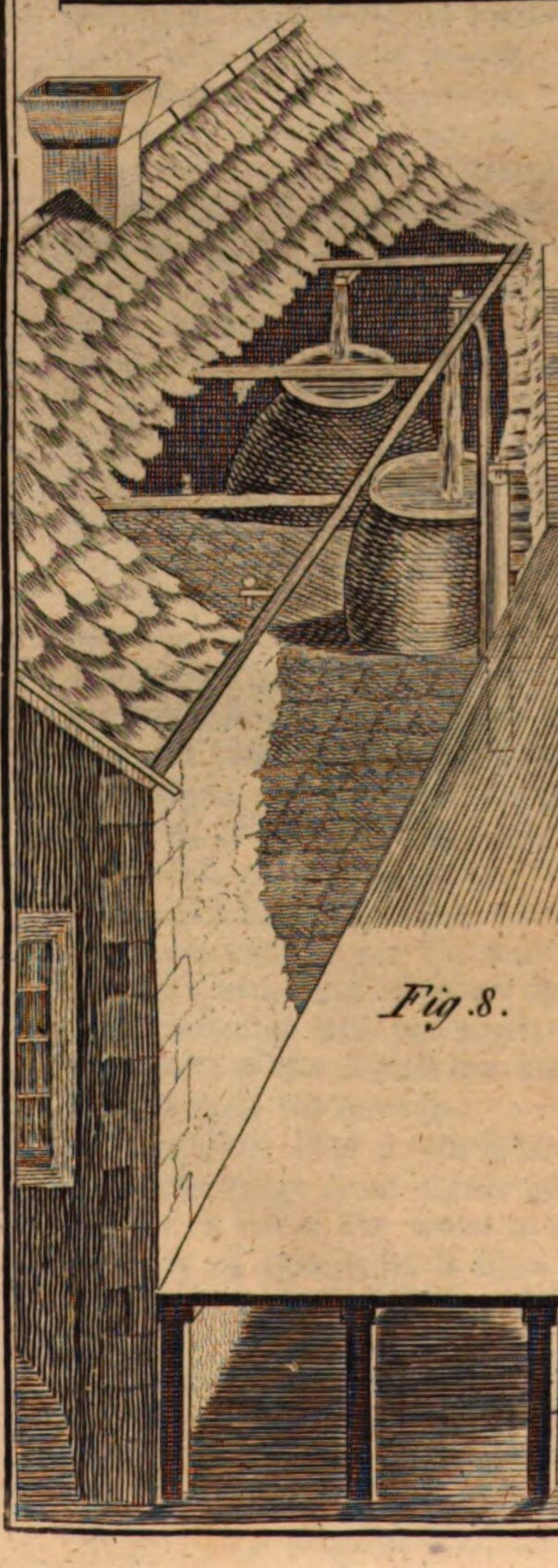


Fig.7.

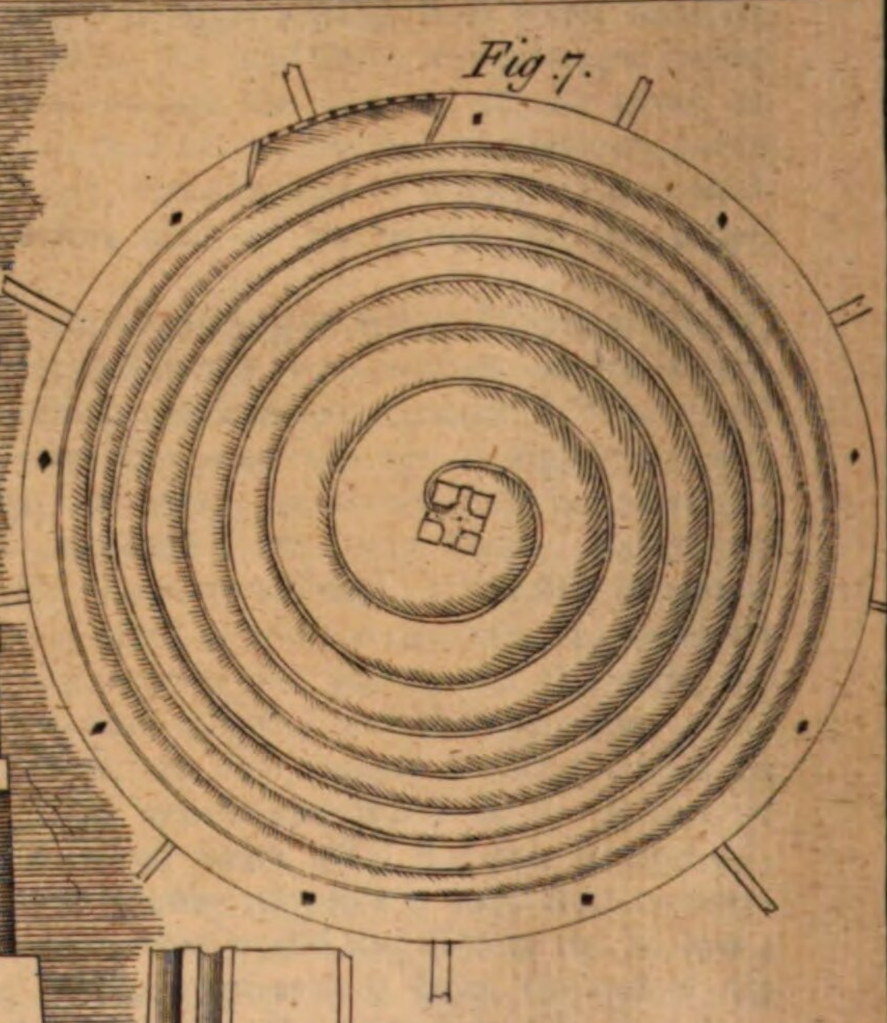


Fig.8.

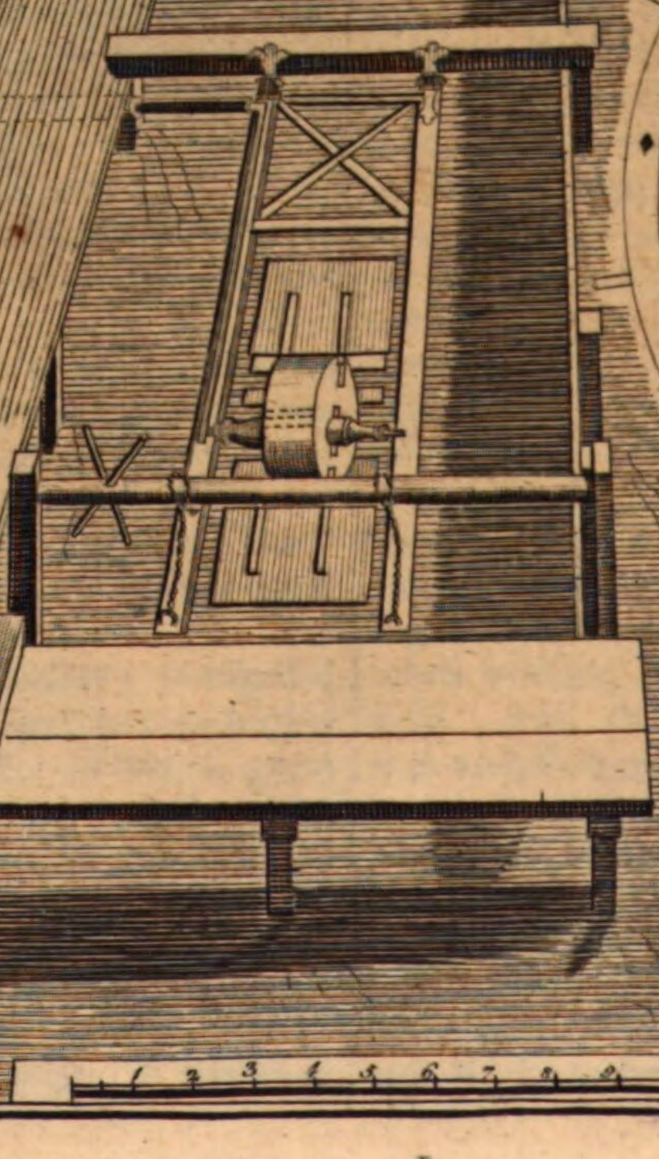
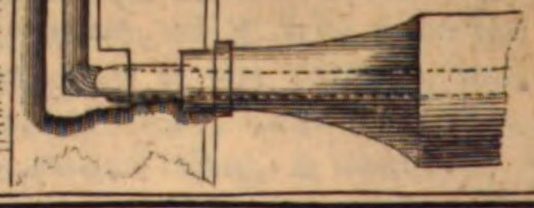


Fig.9.



drains acroſs the ridges, into ſome other furrow, where there is a deſcent, along which it makes its way off of the field.

Drains have been mentioned, as neceſſary for preventing or removing the wetneſs of land, from whatever cauſe it proceeds. There are two kinds of them uſed: open drains, and hollow drains. Hollow drains have ſome peculiar advantages. Being covered with earth, no land is loſt, and they are no impediments in ploughing. On theſe accounts, they are preferable, in ſome caſes, to open drains. But theſe advantages have made ſome perſons uſe them very improperly, and when they could be of very little uſe. In every caſe, open drains will anſwer the purpoſe of draining; and therefore are always to be uſed when it is uncertain whether hollow drains will anſwer the purpoſe. Open drains only are proper for intercepting the overflowings of water from higher ground, and for conveying away water that falls in rain. The reaſon why hollow drains will not anſwer theſe purpoſes, is obvious. The water being on the ſurface, cannot find its way to them: if they are on a declivity, the water will run over them, as it does over any other part of the field: and, if they are in a hollow, the water will ſtagnate even above them, and will be moſtly exhaled before any quantity of it reaches them. But hollow drains may be uſed for intercepting the water of ſprings. Becauſe nothing more is required in this caſe, than to continue the channels of the water below ground to a proper place, where its breaking out can do no harm: for which purpoſe hollow drains are very proper.

Before we leave this article, it will not be improper to obſerve, that land is ſometimes wet from the nature of the ſoil.

There are two kinds of ſoil, that are much expoſed to be damaged by water. The ſoil in which there is a great mixture of clay; and the ſoil in which there is a great mixture of moſs. Experience ſhows, that both theſe kinds of ſoil take much longer time to dry than others, that have received as much water, and are in the ſame ſituation.

We ſhall beſt know how to render theſe ſoils dry, by inquiring into the cauſe of their wetneſs.

It is obſerved, that clay is a heavy body, that it does not eaſily receive water, but that it retains a large quantity, and will not eaſily part with it, when once received. It would ſeem, then, that clay has many pores, but that its pores are ſmall. Having many pores, it is capable of containing a large quantity of water; but, its pores being ſmall, the water does not eaſily enter into it, or paſs through it.

It is obſerved, that moſs has ſtill worſe qualities than clay; for it not only retains a large quantity of water, but alſo eaſily admits it. It would ſeem, then, that its pores are large; but that it has a ſtrong abſorbent quality, or contains a great quantity of undiſſolved oil. The largeneſs of its pores eaſily admits water, and its abſorbent quality, or the undiſſolved oil, which it contains, prevents the paſſage of the water through it.

It is obvious, that laying up ſuch lands in ridges, and caſting drains in proper places, though of ſome uſe, yet will not effectually remove the water; as the ſoil, from its nature, retains too large a quantity, and will not give it a paſſage into the furrows or drains, though there is a ſufficient deſcent. To drain ſuch land, it is neceſſary therefore, by culture, to change the nature of it, and, in ſome meaſure, deſtroy its power of retaining water.

As the pores of clay are ſo ſmall, that water cannot find an eaſy paſſage through it; to drain this kind of ſoil, its pores muſt be enlarged: frequent ſtirring, and the application of ſuch manures as raiſe a fermentation, ſeem to be very proper for this purpoſe. Theſe operations open the pores, render the ſoil free and open, and thereby the water finds a more eaſy paſſage through it. The manures particularly, that are long in diſſolving, are the moſt proper; for, till they are wholly diſſolved, they keep the ſoil continually open.

Some perſons have obſerved, that clay has this bad quality; though reduced to powder, yet, when mixed with water, becomes as ſolid again as ever. As this is the caſe, though manures may help to make it part with the water, as they open the ſoil by fermentation, both in the time of the rain and after it has fallen, yet frequent ploughings can do but little ſervice; on the contrary, by opening the ſoil, make it receive the water more eaſily. It is therefore recommended to all perſons, who have this kind of ſoil to deal with, as a matter of the greateſt importance, to lay up the land, before the rainy ſeaſon comes on, in ſuch a manner, as allows the water the moſt eaſy paſſage, and expoſes it beſt to the influence of the winds. For thereby a great quantity will run off, and be exhaled, which otherwiſe would ſink into the land.

As moſs has its pores too large, and has an abſorbent quality, or a large quantity of undiſſolved oils, which prevents the paſſage of the water thro' it; to drain this kind of ſoil, it is neceſſary to leſſen its pores, render it more compact and firm, and, if poſſible, deſtroy its quality of retaining water. Frequent ſtirring, as already mentioned in the caſe of clay, and the application of ſuch manures as raiſe a fermentation, will leſſen its pores, and render it more firm and ſolid; and thereby prevent it from receiving ſo large a quantity of water. And the application of ſuch manures as tend to make the moſs putrefy, and to diſſolve its oils, will, in ſome meaſure, deſtroy its power of retaining water, and thereby allow it a more eaſy paſſage.

Sometimes it is obſerved that land is wet, though there is in it a great mixture of ſand or gravel. Theſe are kinds of ſoil which allow the water an eaſy paſſage, and are commonly very dry. When they are wet, this muſt be owing to the nature of the bottom. Clay, till, or ſomething that does not eaſily admit water, muſt lie near the ſurface. When this is the caſe, the land, tho' on a declivity, will be wet after violent rain. The water is eaſily admitted by the ſand or gravel on the ſurface; it is reſiſted by the clay, or till, in the bottom; and, tho' it deſcends along theſe, yet the abſorbent quality of the ſoil, and the other interruptions which the water meets with, render its motion very ſlow. When land in this ſituation is on a plain, the qualities of the ſand and gravel can be of little uſe to render it dry. It is needleſs to propoſe drains in either of theſe caſes. The method of ploughing is the only thing that can be of ſervice. Forming the ridges in ſuch a manner as to make many furrows, and placing them in ſuch a manner, as to make the furrows intercept the water, ſeems to be the proper way of draining this kind of land, when on a declivity; and the forming the ridges in ſuch a manner, as beſt to expoſe the ſoil to the influence of the air and winds, ſeems to be the proper way of draining it, when on a plain.

But when the land is above the level of the adjacent water, recourſe muſt be had to ſome engine to raiſe it to a proper height, in order to overflow it; though this will be attended with a very conſiderable expence, eſpecially at firſt.

The oldeſt inſtrument uſed for this purpoſe is known by the name of Archimedes's water ſcrew, and is thus deſcribed by Mr. Emerſon.

C *p* D (plate CXXXVII. *fig.* 1.) is a cylinder which turns upon the axis C D. About this cylinder there is twiſted a pipe, or rather ſeveral pipes, *n o*, *p q*, running ſpiral wiſe from end to end. This cylinder is placed higher at one end, D, than at the other; and its uſe is to ſcrew up the water from the lower end to the higher. A B is a river running in the direction A B; *a*, *b*, *c*, *d*, are ſeveral floats fixed to the cylinder. E F is the ſurface of the water. As the cylinder ſtands in an inclined poſition, the upper floats *a*, *b*, are ſet out of the water, and the under ones *c d* within it; ſo that the water acts only upon the under ones *c*, *d*, and turn about the cylinder in the order *a*, *b*, *c*, *d*. By this motion, the water taken into the ſpiral tubes at the low end is, by the revolution of the cylinder, conveyed through theſe pipes, and diſcharged at the top into the veſſel G. If A B is a ſtanding water, there is no occaſion for the floats *a*, *b*, *c*, *d*; and then the cylinder is to be turned by the handle at D. Inſtead of

the pipe, a ſpiral channel may be cut round the cylinder, and covered cloſe with plates of lead. The cloſer theſe ſpiral tubes are, the more water is raiſed: but it requires more force. Alſo the more the cylinder leans, the more water it carries; but to a leſs height.

Where a conſiderable quantity of water is to be raiſed, a greater force is requiſite, than can be applied to ſuch a handle. Her royal highneſs the princeſs dowager of Wales has cauſed an inſtrument of this kind to be erected at Kew, by the ingenious Mr. Smeaton, and by means thereof a ſufficient quantity of water is ſupplied, for all the ponds, and other uſes, in that elegant and extenſive garden: but it is there worked by horſes.

The moſt common engine for raiſing water is the Perſian wheel, of which Mr. Worlidge gives the following deſcription.

This wheel is made much after the manner of that of an under-ſhot mill, viz. with a double ring, into which are let two pins, on which the floats are faſtened. Theſe floats are made hollow; the half that is the moſt remote from the wheel, holds the water which is taken in at the open place, above the middle of the back of the float, and as the wheel goes round, and the float laden with water riſes, ſo the water, by degrees, tends towards that part of the float which is next the wheel; and as the float ſurmounts the ciſtern or receiver, the water empties itſelf into it, every float ſucceeding one another, and emptying themſelves into the receiver: ſo that if one float contain a gallon of water, and there be thirty floats on the wheel, at one motion round it delivers thirty gallons of water into the ciſtern. Such a wheel will be about fifteen foot diameter, the floats at eighteen inches diſtance, and will deliver the water at eleven or twelve foot above the level of your ſtream, and will go four times round in one minute, and carry up about one hundred and twenty hogſheads of water in an hour, with twelve or eighteen inches penning or ſtopping of but an ordinary current of water, which will water very well thirty or forty acres of land: for if your land be cold and clayey, too much water does it hurt; and if it be light, warm, or ſandy, a little water does it much good. It is alſo to be obſerved, that this motion is conſtant, and will laſt many years without repair, ſo that it ſtand not ſtill, for one ſide to dry and wax lighter than the other: alſo obſerve, that the ſlower it moves, the better it delivers the water.

Fig. 2. repreſents the view of this wheel; *a*, *a*, *a*, *a*, ſignify the wheel; *b*, the ciſtern that receives the water; *c*, *c*, the trough ſtanding on treſſels, that conveys the water from the ciſtern to the place you deſire; *d*, the hatch, or pen-ſtock that bays up the water to a reaſonable height, under which the water drives the wheel; *e*, *fig.* 3, one of the floats preſented open to your eye, apart from the wheel; *f*, the place that is to receive the water; *g*, the open place out of which the water iſſues; *h*, *h*, the two pins or ledges riveted on to the foreſide of the float, and wherewith you are to fix the float to the two rings of the wheel.

Theſe, or ſuch like wheels, are much uſed in Spain, Italy, and France, and are eſteemed the moſt eaſy and advantageous way of raiſing water in great quantity, to any height within the diameter of the wheel, where there is any current of water, to continue it in motion, which a ſmall ſtream will do.

How many acres of land lie on the declining ſides of hills, by the ſides of rivers, in many places where the water cannot be brought unto it by any ordinary way? yet by this wheel placed in the river, may the land be continually watered, ſo far as is under the level of the water when raiſed.

Inſtead of raiſing the water by means of the hollow floats placed around the outer circumference of the rim of the wheel, as here deſcribed; M. Belidor propoſes, ſeveral wheels of this kind, to raiſe it in buckets placed at equal diſtances upon the ſide of the rim of the wheel, and ſuſpended by a pin, upon which they play, as at A, *fig.* 4. When by the rotation of the wheel, one of theſe buckets comes to B, which is the ſummit of the wheel, the upright piece D, which is faſtened to the ſide of the trough C, turns that bucket upon its ſide, and thereby makes it empty itſelf into the trough C, from whence the water is diſcharged into a receiver at E. — As theſe buckets keep full of water till they are carried up to the top of the wheel, where they are turned over, a much greater quantity of water may, undoubtedly, be raiſed by them, than can be by the floats of the Perſian wheel, from which much muſt be ſpilled as it is carrying up. The ſize of theſe buckets ſhould be adapted to the force of the current of the water which they are to take up.

Another wheel for raſing water, tho' not to ſo great a height, is repreſented in *fig.* 5. This engine was firſt invented by M. de la Faye of the Royal Academy of Sciences at Paris, and is now uſed with great ſucceſs by the honourable Mr. Hamilton, at his ſeat at Pain's-hill in Surry, where that gentleman has ſhewn how far a barren ſpot may not only be rendered uſeful but even an ornament to the adjacent country.

This machine conſiſts of a wheel whoſe ſize is adapted to the height to which it is intended to raiſe the water. A perſpective view of this machine is repreſented *fig.* 5. and its internal parts *fig.* 6. The wheel turns upon its axis at A, and has ſeveral curved pipes, B, C, D, E, fixed to it, as repreſented in the figures. The mouth of each pipe aſcends as the wheel is turned round by the ſtream, in the direction indicated by an arrow, and the water deſcends from C towards F, till it reaches the hollow axis, A, A, from the opening at the end of which it is diſcharged into the trough G, and thence conducted by troughs, as H, or other channels, to whatever place it may be wanted.

But if there be a neceſſity to raiſe the water higher than the axis of the wheel, we would recommend an ingenious machine, uſed for above twenty years at Zurich, for ſupplying a large dye-houſe there with water from the Limmat, and of which a deſcription in the German language appeared in the third volume of the Zurich Acts, from whence the following account is tranſlated.

The wheel itſelf differs little in appearance from other water-wheels. Its diameter, excluſive of the ladle-boards, is not quite three feet. It is coated all over with tin plates, and forms a ſhort cylinder, or rather drum, of the above diameter, and one foot thick. On its periphery the ladle-boards are fixed, as in other under-ſhot water-wheels, and by means of which it is put in motion by the ſtream. It turns on a hollow axis, like the laſt machine, of proportional thickneſs and length, and has one of its flat ſides applied againſt a projection, or ledge, made round the axis, to which it is preſſed cloſe, and held faſt by a wedge driven through the axis at the other ſide. That part of the axis which paſſes through the wheel is ſquare, that the wheel may not ſlip, or be able to turn, without turning the axis with it: the remaining part of it is round. The wheel is hung in the water to about one third of its height, and ſupported in a moveable frame, ſo that it can be lowered, raiſed, or even taken out of the water at pleaſure. In the periphery of the wheel are holes, by which the water enters. The axis turns as uſual, on two pivots, one of which is of braſs, conſiderably larger than the other, and hollow from end to end, communicating with the canal in the axis. The hollow pivot, which may be conſidered as a braſs pipe, has its end fitted cloſe to a leaden pipe, in which it turns. The leaden pipe, by a double bending, is confined to the wall of the dye-houſe, where it is bent perpendicularly upwards, and riſes along the wall to the height of ten feet above the axis; it is there bent again under the eaves, and continued into the dye-houſe itſelf.

The ſingular and remarkable operation of this little wheel depends ſolely on its internal ſtructure. The water entering at the circumference of the wheel, runs in a ſquare ſpiral canal, which paſſes round the wheel, and conſiſts of a number of circumvolutions, within one another, like the ſpring of a watch, till at length it comes into the axis. A neceſſary condition here is, that each of the inner circumvolutions be of the ſame magnitude with regard to their content, as the outer one; or

that

that the width of the ſpiral canal be gradually enlarged in each circumvolution, in proportion as the diameter diminiſhes; that is, the bore of each of the inner ſpirals muſt be to the bore of the outer one, as the diameter of the latter is to the diameter of the former.

The wheel thus furniſhed with its ſpiral canal, is to be hung ſo deep in the river, that half a ſpiral, at leaſt, may, in each revolution, be filled with water. To keep it in this ſtate it would be neceſſary to immerſe it to the axis, or further: but as its motion, at ſuch a depth, would be extremely ſlow, a kind of ſcoop is made at the outer opening of the ſpiral pipe, which takes up ſo much water at once, as is ſufficient to fill the due proportion of the outermoſt ſpiral in one revolution. One half of the outer ſpiral being thus filled with water, the other half remains filled with air: as the wheel turns, the water and air paſs into the ſecond ſpiral, then into the third, fourth, and ſo on, till a ſufficient number of turns brings the water and air to the axis, from whence they paſs into the upright pipe, as already mentioned: thus the entrance and diſcharge of water continue without intermiſſion, ſo long as the wheel is kept in motion. When the wheel ſcoops up juſt the proper quantity of water, and turns with due velocity, the water may be forced up in the perpendicular pipe to a height equal to the ſum of the diameters of all the circumvolutions of the ſpiral canal.

If we conſider the operation of this machine, we ſhall eaſily ſee the neceſſity of the inner circumvolutions being made to widen in the proportion above mentioned; and that, without this condition, the water paſſing from the large outer ſpiral, would be crouded and retarded in the inner, and in great part forced back.

It is alſo obvious that juſt half of one of the ſpirals muſt be filled with water at each revolution; for if leſs be taken in, there will be a diminution in the quantity delivered, and if more, it will be preſſed too much together, and its quantity alſo diminiſhed.

The velocity with which the wheel moves, or the number of revolutions it makes in a given time, is another eſſential point in regard to the quantity of water, and may conſiderably influence the quantity of water neceſſary to be raiſed. When this is known, and the height determined, it will be eaſy to conſtruct a wheel in ſuch a manner, as to anſwer the purpoſe intended.

We ſhall conclude our account of this ingenious contrivance, with the following directions for conſtructing it. The two flat ſides of the wheel ſhould be made of two ſtrong circular pieces of good oak, the inner ſides of which muſt be planed as ſmooth as poſſible, and fitted to one another; and to keep them from bending or warping, ſecured by pieces on the outſide. The plan of the ſpiral lines is repreſented in *fig.* 7. Theſe ſpiral lines being marked out on the wood, a groove muſt be cut about a quarter of an inch deep, in order to make a channel for the partition, which muſt be formed of a thin piece of copper. The channel being filled ſomewhat more than half with good cement that will bear water, the piece of copper muſt be ſet in regularly, care being taken to keep the cement warm, or previouſly to heat the metal. The ſcoop alſo, which at every revolution of the wheel takes up a proper quantity of water from the wheel, may be made of the ſame metalline plate. The piece of copper for forming the partition muſt be cut at firſt exactly ſtrait, and of an equal breadth throughout. This work being finiſhed, the wheel muſt be put on the axis as far as the ledge made for it to reſt againſt, and cemented. The ſecond piece of wood requires little preparation: ſome cement muſt be ſpread all over it, and the whole ſurface covered with a thick piece of woollen cloth, which muſt alſo be done over with cement on both ſides: while the whole continues warm, it muſt be put on the axis, and preſſed cloſe to the other part of the wheel, ſo as to cover the as yet open ſide of the ſpirals. The two parts are held firm together, by means of a wedge or key paſſing through the axis, and a proper number of ſcrews, placed round the circumference: theſe ſcrews are ſtrong iron pins, ſomewhat longer than the wheel is thick, and a nut, when they are placed through the wheel, is ſcrewed on the other. Thus the inſide of the wheel, or drum is finiſhed. The diſpoſition of the ladle-boards, the ſhape of the axis, and the ſtructure of the frame by which the machine is ſupported, will be partly underſtood from what has been already ſaid, and more fully from *fig.* 8.

It has been already obſerved, that the wheel in the Limmat is covered with tin plates; but this is of little or no conſequence. It is however adviſeable not to have one large opening, for the entrance of the water, but either a perforated plate, or a wire-grating nailed before it, in order to prevent weeds, or any other filth from paſſing into the ſpiral tube, and preventing, if not wholly ſtopping, the courſe of the water.

The frame or ſcaffold in which the wheel hangs, and the means of raiſing or lowering it in the river, without diſturbing the courſe of the water in the machine, deſerves particular notice. It is plain from *fig. L.* that the wheel reſts on two arms, which, for the greater ſecurity, are bound together by croſs-pieces. At the fore-end they are both ſuſpended by iron chains, which paſs over a roller ſo as to be wound off or on; on the other end they move on two ſtrong joints or hinges. The communication of the leaden pipe with the braſs one, or hollow pivot, at the end of the axis, is drawn on a larger ſcale, in *fig.* 9. This pipe is bent cloſe by the pin, to a right angle, and goes horizontally along one of the arms of the frame as far as the hinge, (ſee *fig.* 10.) where it is again bent to a right angle, oppoſite to the dye-houſe, and communicates in the ſame manner as the hollow pivot of the axis, with another horizontal pipe, in which it moves round freely, without any impediment to the paſſage of the water, in raiſing or lowering the wheel. This large pipe paſſes under a ſtage built along the wall of the dye-houſe, and thence up the wall, where it diſtributes the water in the manner repreſented in the figure.

But though water is ſo neceſſary to the growth of plants, yet in lands that abound with it, there is a neceſſity for conveying it away, the beſt methods for doing which the reader will find under the articles BOG, FEN, &c.

WATER, in medicine, pharmacy, &c. called alſo artificial and medicated waters, are a kind of liquors procured or prepared by art from divers bodies, principally of the vegetable tribe, having various properties, and ſerving for various purpoſes. Theſe waters are either ſimple, or compound; ſimple waters are thoſe procured from ſome one vegetable body, the intention of which is to draw out the virtues of the herb, ſeed, flower, root, or the like, ſo as it may be more conveniently given in that form than any other. The means whereby this ſeparation is effected, are either evaporation, infuſion, decoction, or diſtillation.

The ſimple waters of chief virtue are the following ones, viz. dill water, angelica-water, mint-water, roſemary-water, orange-flower-water, black-cherry-water, parſley-water, camomile water, penny-royal-water, fennel-water, damaſk roſe-water, hyſſop-water, rue-water, juniper-water, elder-water, lovage-water, carminative-water, &c. for the virtues of each whereof we refer the reader to thoſe aſcribed to the ſeveral plants, or other bodies from whence the water is procured, which may be found under their proper heads in the courſe of this work.

Compound-waters, or thoſe wherein ſeveral ingredients are uſed, are very numerous, and make a large article in commerce; ſome prepared by the apothecaries, according to the diſpenſatory preſcripts, for medicinal uſes; others by the diſtillers, to be drank by way of dram; and others by the perfumers, &c. They are diſtinguiſhed by different epithets, &c. in reſpect either of the ſpecific virtues of the waters, or the parts of the body for the cure whereof they are intended, or the diſeaſes they are good againſt, or the ingredients they are compounded of, or their different uſes, &c.

The moſt conſiderable among the claſs of compound-waters, are alexipharmic or alexiterial waters, ſuch as treacle-water, plague-water, milk-water, poppy-water, &c.

&c. alum-water, angelica-water, anniſeed-water, apricot-water, aromatic-water, arthritic-water, bryony-water, carduus-water, water of ſeparation, or depart, cauſtic-water, cephalic-water, chalybeat-water, cinnamon-water, clary-water, clove-water, cordial-water, coſmetic-water, gentian-water, gum-water, hepatic-water, honey-water, hungary-water, hyſteric water, iced or frozen-water, imperial-water, lime-water, aqua mirabilis, or the wonderful-water, nephritic-water, ophthalmic-water, orange-water, peach-water, poppy-water, pyony-water, roſe-water, ſcordium-water, ſpecific-water, ſplenetic-water, ſtomachic-water, ſtyptic-water, treacle-water, vulnerary-water, &c.

As theſe waters are exceeding numerous, and the manner of making them is not always the ſame, we muſt refer the chemical or medical reader to the diſpenſatories, wherein he will find, that every one gives his own method as the beſt one.

We have only three general remarks to add, with regard to thoſe intended for drinking. 1. That ſuch wherein any thing is infuſed, as bruiſed fruits, pounded herbs, &c. or ground ſpices, muſt be always paſſed through a filtre, to make them finer and purer. 2. That thoſe made with brandy, or ſpirit of wine, are uſually diſtilled after mixing their ingredients, which renders thoſe liquors exceeding ſtrong and dangerous. 3. That the waters which take their name from particular things, as cinnamon, &c. have often ſome other ingredients joined with them, according to the taſte and ſmell required.

WATER ORDEAL, or TRIAL, among our anceſtors, was of two kinds, by hot and by cold water. Trial or purgation by boiling or hot water, was a way of proving crimes, by immerging the body, or the arm, in hot water, with divers religious ceremonies. In the judgment by boiling water, the accuſed, or he who perſonated the accuſed, was obliged to put his naked arm into a caldron full of boiling water, and to draw out a ſtone thence placed at a greater or leſs depth, according to the quality of the crime. This done, the arm was wrapped up, and the judge ſet his ſeal on the cloth, and at the end of three days they returned to view it, when if it was found without any ſcald, the accuſed was declared innocent.

The nobles, or great perſonages, purged themſelves thus, by hot-water, and the populace by cold water.

The trial, or purgation by cold water, was thus: after certain prayers and other ceremonies, the accuſed was ſwaddled, or tied up, all in a pelotoon or lump, and thus caſt into a river, lake, or veſſel of cold water, where if he ſunk he was held criminal, if he floated innocent.

In the Levitical law, we find mention made of water which ſerved to prove, whether or no a woman was an adultereſs; the formula, as it was performed by the prieſt, may be ſeen in the fifth chapter of the book of Numbers.

WATER, among jewellers, is properly the colour or luſtre of diamonds and pearls. The term, though leſs properly, is ſometimes uſed for the hue or colour of other ſtones.

WATER-BAILIFF, is an officer in ſea-port towns, appointed for the ſearching of ſhips; and in London, the water-bailiff hath the ſuperviſing and ſearch of fiſh, brought thither; and the gathering of the toll ariſing from the Thames; his office is likewiſe to arreſt men for debt, &c. or other perſonal or criminal matters upon the river Thames.

WATER-BORNE, in the ſea-language. A ſhip is ſaid to be water-borne, when ſhe is, where there is no more water than will barely bear her from the ground; or when lying even with the ground, ſhe firſt begins to float or ſwim.

WATER-COLOURS, in painting, are ſuch colours as are only diluted and mixed up with gum-water, in contradiſtinction to oil-colours.

The uſe of water-colours makes what we call limning, as that of oil-colours does painting, properly ſo called.

WATER-FARCEY, a diſeaſe incident to horſes, and is of two kinds; one the product of a feveriſh diſpoſition terminating on the ſkin, as often happens in epidemical colds; the other is dropſical, where the water is not confined to the belly and limbs, but ſhews itſelf in ſeveral parts of the body, by ſoft ſwellings yielding to the preſſure of the finger. This laſt kind uſually proceeds from foul feeding, or from the latter graſs and fog, that often comes up in great plenty with continued cold rains, and breeds a ſluggiſh viſcid blood. In the former caſe, I have ſeen the limbs and whole body enormouſly ſwelled, and very hard, the belly and ſheath greatly diſtended; which were as ſurprizingly reduced in four and twenty hours, by ſlight ſcarifications within ſide the leg and thigh, with a ſharp penknife, and three or four ſtrokes on the ſkin of the belly on each ſide the ſheath; from theſe ſcarifications there was a conſtant and ſurpriſing large dripping of water, which ſoon relieved the horſe; when a few purges compleated his recovery.

In the other ſpecies of dropſy the curative intentions are to diſcharge the water, recover the craſis or ſtrength of the blood, and brace up the relaxed fibres throughout the whole body. To this end, purge once a week or ten days; and give intermediately either of the following drinks, or balls.

Take black hellebore freſh gathered, two pounds; waſh, bruiſe, and boil in ſix quarts of water, to four; then ſtrain out the liquor, and put two quarts of white wine on the remaining hellebore, and let it infuſe warm forty-eight hours; then ſtrain off, mix both together, and give the horſe a pint night and morning.

Take nitre two ounces, ſquills powdered, three drams, or half an ounce; camphor one dram, honey enough to form into a ball, to be given once a day alone, or waſhed down with a horn or two of the above drink.

Take of the leaves and bark of elder, of each a large handful; chamomile flowers half a handful, juniper berries bruiſed two ounces; boil in a quart of water to a pint and a half, to which add honey and nitre of each one ounce.

Give this drink every night, or night and morning; and to compleat the cure, and ſtrengthen the whole body, give a pint of the ſubſequent infuſion every night and morning, for a fortnight, faſting two hours after it.

Take gentian root and zedoary, of each four ounces; chamomile flowers and the tops of centaury, of each two handfuls; Jeſuits bark powdered two ounces; juniper berries four ounces; filings of iron, half a pound: infuſe in two gallons of ale for a week, ſhaking now and then the veſſel.

Before we cloſe this article, we think proper to lay down the ſymptoms of an incurable farcy, that the owners of ſuch horſes may ſave themſelves unneceſſary expence and trouble in their endeavours to obtain a cure.

When a farcy by improper applications, or by neglect has ſpread and increaſed; or after long continuance reſiſted the medicines above recommended; if freſh buds are continually ſprouting forth, while the old ones remain foul and ill-conditioned; if they riſe on the ſpines of the back and loins; if the horſe grows hide-bound, and runs at the noſe; if abſceſſes are formed in the fleſhy parts between the interſtices of the large muſcles; if his eyes look dead and lifeleſs; if he forſakes his food and ſcours often, and his excrements appear thin, and of a blackiſh colour; if the plate, or thigh vein continue large after firing, and other proper applications: theſe ſymptoms denote the diſtemper to have penetrated internally, and that it will degenerate into an incurable conſumption: it is alſo moſt probable, that the whole maſs of fluids are tainted and become incurable by art. *Bartlet's Farriery.*

Dead WATER, in the ſea-language, is the eddy-water that follows the ſtern of a ſhip, not paſſing away ſo faſt as that which ſlides by her ſides.

WATER GANG, a channel cut to drain a place by carrying off a ſtream of water.

WATER-LINE *of a ſhip*, a line which diſtinguiſhes that part of her under water from that above, when ſhe is duly laden.

WATER-

Fig. 1.

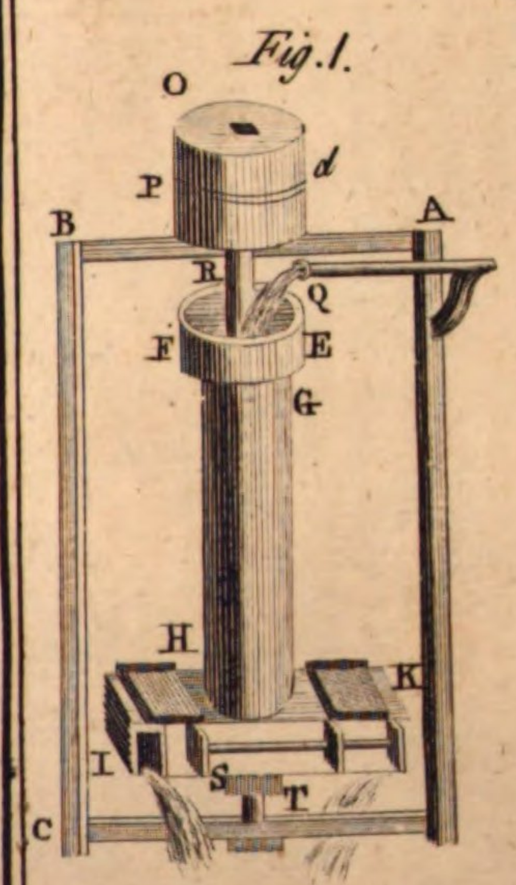
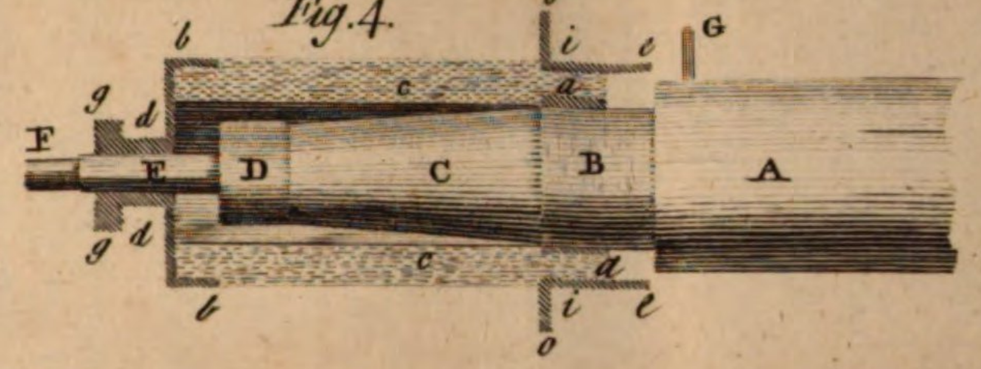
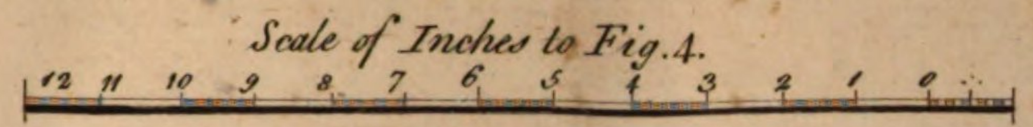


Fig. 4.

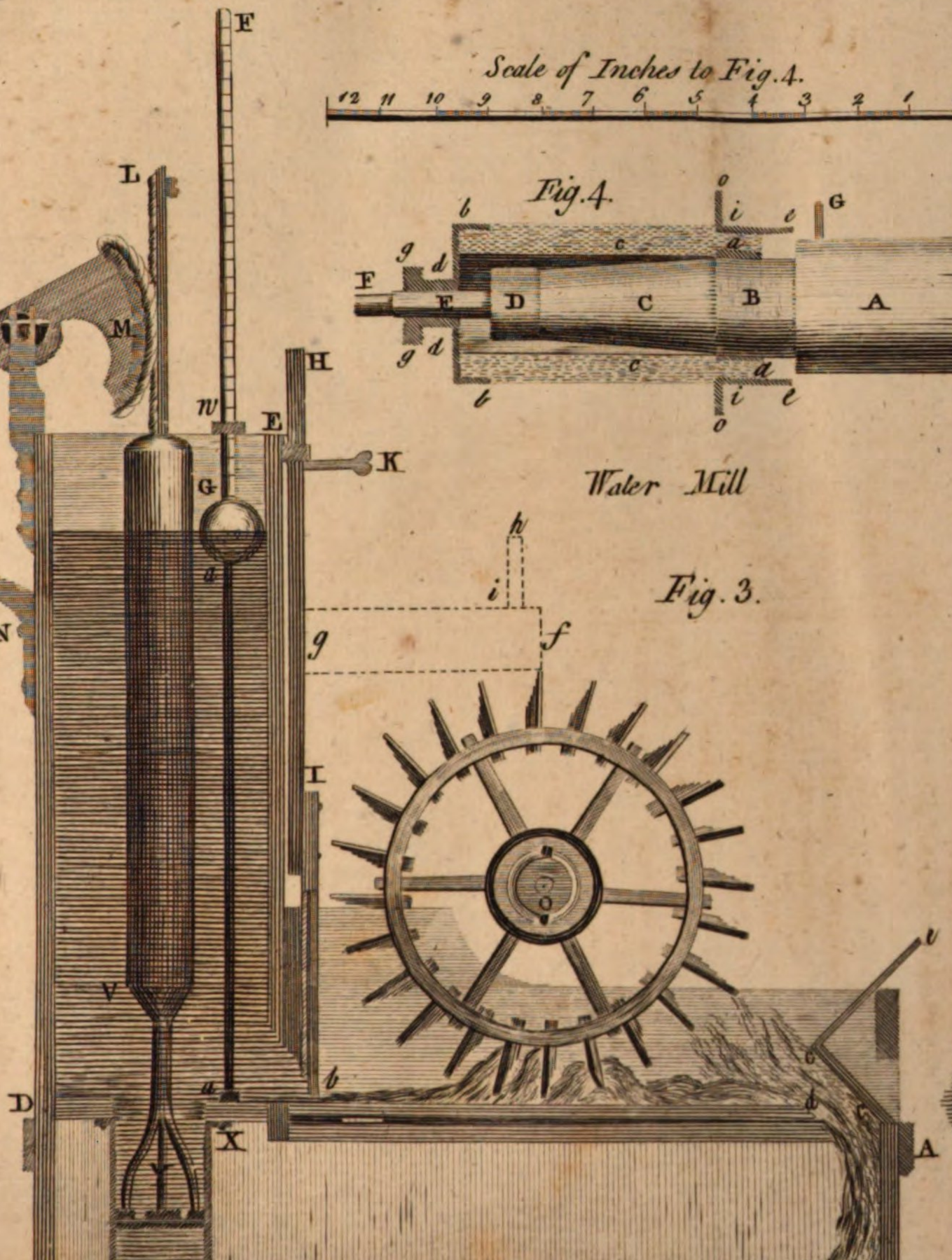


Scale of Inches to Fig. 4.



Water Mill

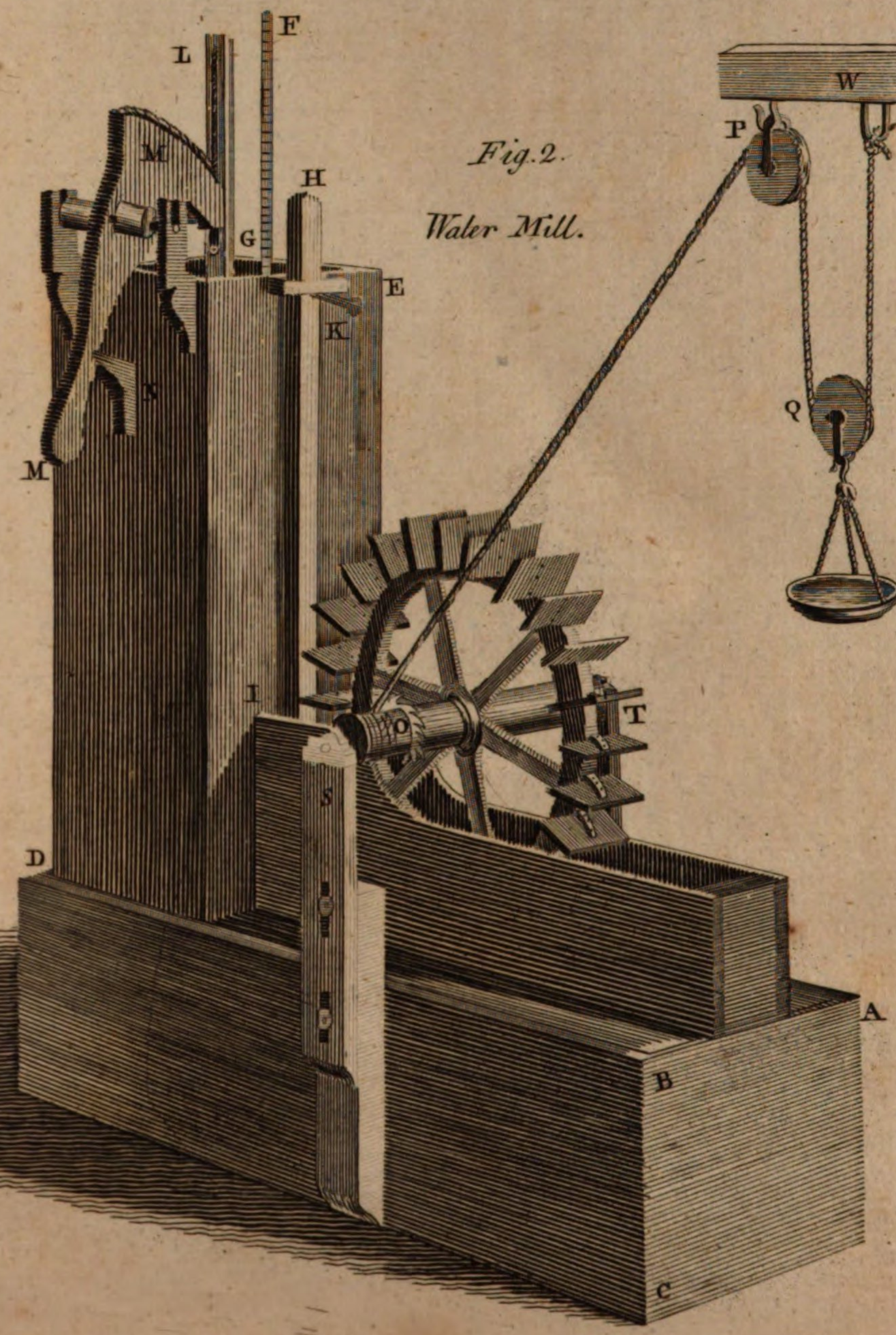
Fig. 3.



Scale of Feet to Fig. 3.

Fig. 2.

Water Mill.



WATER-MEASURE. Salt, ſea-coal, &c. while aboard veſſels in the pool or river, are meaſured with the corn-buſhel heaped up; or elſe five ſtricked pecks are allowed to the buſhel. This is called water-meaſure. See MEASURE.

WATER-MEN are ſuch as row in boats, or ply on the river Thames, in the government of whom the lord-mayor of London, and court of aldermen there, had always great power. They ſtill have the appointing of their fares, the taking more than which, makes them liable to a fine of forty ſhillings and half a year's impriſonment. The fares aſſeſſed are, from London-bridge to Limehouſe, Ratcliff-croſs, &c. oars, 1 s. ſcullers, 6 d. to Wapping-dock, Rotherhithe-church-ſtairs, &c. oars, 6 d. ſcullers, 3 d. from either ſide of the water above the Bridge to Lambeth and Vauxhall, oars, 1 s. ſcullers, 6 d. all the ſtairs between London-bridge and Weſtminſter, oars, 6 d. ſcullers, 3 d.

Watermens boats ought to be twelve feet and a half in length, and four and a half in breadth; and no apprentice to any waterman ſhall take upon him the care of a boat till he is ſixteen years of age, if a waterman's ſon; and ſeventeen, if a landman's ſon, unleſs he has worked with ſome able waterman two years, &c.

No tilt-boat, or row-barge, &c. may take in above thirty-ſeven paſſengers, or three more by the way; nor any boat above eight paſſengers, and two by the way, elſe they forfeit 5 l. for the firſt offence, and 10 l. for the ſecond, &c. and if any perſon be drowned when a greater number are taken in, the waterman is declared guilty of felony, and may be tranſported, &c.

WATER-MILL, a machine for grinding corn, &c. driven by the water.

In water-mills, the momentum of the falling water is the power; the force to be overcome is the great attrition of the two ſtones in grinding the corn, &c. which is effected wholly by a complication of wheels and axles. A query may here be put, Why, ſince the power conſtantly acts upon the wheel, the motion of the wheel ſhould be equable, and not accelerated? The anſwer is, The increments of velocity keep riſing, till their momentum is equalled by the reſiſtance of the machine; after which æquilibrium, the wheel goes on with an uniform motion.

Dr. Barker has invented a mill of the moſt ſimple ſtructure of any yet made, performing its effect without any wheel, trundle, cog, or round; the nature of the machine, and manner of its operation, will be eaſy to underſtand from the following account of its ſeveral parts:

A B C D (plate CXXXVIII. *fig.* 1.) is an upright frame ſtanding on a proper baſe; E F is the wider part of G H an upright hollow pipe or tube, fixed at the bottom of an horizontal ſquare trunk I K; which trunk, together with the tube, is fixed to an upright ſpindle or axis R S, by means of a nut and ſcrew at S. The lower end of the axis on a fine point moves in the pivot-hole in the part of the frame at T; on the upper part of the frame is a hole through which the ſpindle paſſes, as alſo through the round circular piece P fixed on the ſaid frame; on the upper part of the ſpindle is fixed another round circular piece O, which repreſents the upper moveable ſtone of the mill. Q is a ſpout of water filling the tube or trunk, and giving motion thereto, and, conſequently, to the axis and upper ſtone, by the horizontal jets of water from each end of the trunk I K, through holes made at each end on contrary ſides.

While the hole continue ſtopped, the trunk will be at reſt, becauſe then the preſſure is equal over all the

While the holes continue ſtopped, the trunk will be at reſt, becauſe then the preſſure is equal over all the parts; but when the holes are open, the preſſure of the water (by its having liberty to iſſue out) will be leſs on that part where the hole is, than on the other part oppoſite to it; which ſtronger preſſure will prevail, and carry round the trunk and tube with the axle and ſtone, in a contrary direction; and each hole contributes to produce this motion, which will be greater or leſſer in proportion to the momenta of the jets of water, or greater or leſſer aperture of the holes.

For it is eaſy to underſtand, that the power of this machine is derived from, or depends upon three things: 1. The velocity of the ſpouting-water; 2. The quantity thereof; and, 3. The diſtance at which the water ſpouts from the axis of motion. The two firſt make the momentum ariſing from the preſſure of the fluid, which is proportional to the altitude, or height of the tube; the laſt is of a mechanical nature; for the trunk is in this reſpect exactly of the nature of the lever.

The ingenious Mr. Smeaton, in the Philoſophical Tranſactions, VOL. LI. part I. has given us the following experimental obſervations concerning water-mills, which every mechanic will do well to obſerve, in conſtructing theſe uſeful machines.

Concerning UNDERSHOT WATER-WHEELS.

Plate CXXXVIII. *fig.* 2. is a perſpective view of the machine for experiments on water-wheels; wherein

A B C D is the lower ciſtern, or magazine, for receiving the water, after it has quitted the wheel; and for ſupplying

D E the upper ciſtern, or head; wherein the water being raiſed to any height required, by a pump, that height is ſhewn by

F G, a ſmall rod, divided into inches and parts; with a float at the bottom, to move the rod up and down, as the ſurface of the water riſes and falls.

H I is a rod by which the ſluice is drawn, and ſtopt at any height required, by means of

K a pin or peg, which fits ſeveral holes, placed in the manner of a diagonal ſcale, upon the face of the rod H I.

G L is the upper part of the rod of the pump, for drawing the water out of the lower ciſtern, in order to raiſe and keep up the ſurface thereof at its deſired height, in the head D E; thereby to ſupply the water, expended by the aperture of the ſluice.

M M is the arch and handle for working the pump, which is limited in its ſtroke by

N a piece for ſtopping the handle from raiſing the piſton too high; that alſo being prevented from going too low, by meeting the bottom of the barrel.

O is the cylinder, upon which a cord winds, and which being conducted over the pullies P and Q, raiſes

R, the ſcale, into which the weights are put, for trying the power of the water.

S T the two ſtandards, which ſupport the wheel, are made to ſlide up and down, in order to adjuſt the wheel, as near as poſſible, to the floor of the conduit.

W the beam which ſupports the ſcale and pullies; this is repreſented as but little higher than the machine, for the ſake of bringing the figure into a moderate compaſs, but in reality is placed 15 or 16 feet higher than the wheel.

Fig. 3. is a ſection of the ſame machine, wherein the ſame parts are marked with the ſame letters as in *fig.* 2. Beſides which

X X is the pump barrel, being 5 inches diameter, and 11 inches long.

Y is the piſton; and

Z the fixed valve.

G V is a cylinder of wood, fixed upon the pump-rod, and reaches above the ſurface of the water; this piece of wood being of ſuch a thickneſs, that its ſection is half the area of that of the pump-barrel, will cauſe the ſurface of water to riſe in the head, as much while the piſton is deſcending, as while it is riſing: and will thereby keep the gauge-rod F G more equally to its height. *Note*, the arch and handle M M is here repreſented on a different ſide to what it is ſhewn in the preceding figures, in order that its dimenſions may the better appear.

a a ſhews one of the two wires which ſerve as directors to the float, in order that the gauge rod F G may be kept perpendicular; for the ſame purpoſe alſo ſerves *w*, a piece of wood with a hole to receive the gauge-rod, and keep it upright.

b is the aperture of the ſluice.

c c a kant-board, for throwing the water more directly down the opening *c d*, into the lower ciſtern: and

c e is a ſloping board, for bringing back the water that is thrown up by the floats of the wheel.

Fig. 4. repreſents one end of the main axis, with a ſection of the moveable cylinder, marked O in the preceding figures.

A B C D is the end of the axis; whereof the parts

B and D are covered with ferrules or hoops of braſs.

E is a cylinder of metal; whereof the part marked

F is the pivot or gudgeon.

c c is the ſection of an hollow cylinder of wood, the diameter of the interior part being ſomewhat larger than the cylindrical ferrule B.

a a is the ſection of a ferrule of braſs, driven into the end of the hollow cylinder, and which is adjuſted to that marked B, ſo as to ſlide freely thereupon, but with as little ſhake as poſſible.

b b, *d d*, *g g*, repreſent the ſection of a braſs ferrule, plate, and ſocket, fixed upon the other end of the hollow cylinder; the ſocket *d d* being adjuſted to ſlide freely upon the cylinder E, in the ſame manner as the ferrule *a a* ſlides upon the cylinder B: the outer end of the ſocket at

g g is formed into a ſort of button; by puſhing whereof, the hollow cylinder will move backwards and forwards, or turn round at pleaſure upon the cylindrical parts of the axis B and E.

e e, *i i*, *o o*, repreſent the ſection of a braſs ferrule, alſo fixed upon the hollow cylinder: the edge of this ferrule

e e is cut into teeth, in the manner of a contrate wheel; and the edge thereof

o o is cut in the manner of a ratchett.

Of conſequence, when the plate *b d d b* is puſhed cloſe to the ferrule D, the teeth of the ferrule *e e* will lay hold of

G, a pin fixed into the axis; by which means the hollow cylinder is made to turn along with the wheel and axis: but being drawn back by the button *g g*, the hollow cylinder is thereby diſengaged from the pin G, and ceaſes turning.

Note. The weight in the ſcale is prevented from running back, by a catch that plays in and lays hold of the ratchet *o o*.

By this means the hollow cylinder upon which the cord winds, and raiſes the weight, is put in action and diſcharged therefrom inſtantaneouſly, while the wheel is in motion: for without ſome contrivance of this kind, it would not be eaſy to make this ſort of experiments with any tolerable degree of exactneſs.

The uſe of the apparatus now deſcribed will be rendered more intelligible, by giving a general idea of what I had in view; but as I ſhall be obliged to make uſe of a term which has heretofore been the cauſe of diſputation, I think it neceſſary to aſſign the ſenſe in which I would be underſtood to uſe it; and in which I apprehend it is uſed by practical mechanicks.

The word power, as uſed in practical mechanicks, I apprehend to ſignify the exertion of ſtrength, gravitation, impulſe, or preſſure, ſo as to produce motion: and by means of ſtrength, gravitation, impulſe, or preſſure, compounded with motion, to be capable of producing an effect: and that no effect is properly mechanical, but what requires ſuch a kind of power to produce it.

The raiſing of a weight, relative to the height to which it can be raiſed in a given time, is the moſt proper meaſure of power; or, in other words, if the weight raiſed is multiplied by the height to which it can be raiſed in a given time, the product is the meaſure of the power raiſing it; and conſequently, all thoſe powers are equal, whoſe products, made by ſuch multiplication, are equal: for if a power can raiſe twice the weight to the ſame height; or the ſame weight to twice the height, in the ſame time that another power can, the firſt power is double the ſecond: and if a power can raiſe half the weight to double the height; or double the weight to half the height, in the ſame time that another can, thoſe two powers are equal. But note, all this is to be underſtood in caſe of flow or equable motion of the body raiſed; for in quick, accelerated, or retarded motions, the vis inertiæ of the matter moved will make a variation.

In comparing the effects produced by water-wheels, with the powers producing them; or, in other words, to know what part of the original power is neceſſarily loſt in the application, we muſt previouſly know how much of the power is ſpent in overcoming the friction of the machinery, and the reſiſtance of the air; alſo what is the real velocity of the water at the inſtant that it ſtrikes the wheel; and the real quantity of water expended in a given time.

From the velocity of the water, at the inſtant that it ſtrikes the wheel, given; the height of head productive of ſuch velocity can be deduced, from acknowledged and experimented principles of hydroſtatics: ſo that by multiplying the quantity, or weight of water, really expended in a given time, by the height of head ſo obtained; which muſt be conſidered as the height from which that weight of water had deſcended in that given time; we ſhall have a product, equal to the original power of the water; and clear of all uncertainty, that would ariſe from the friction of the water, in paſſing ſmall apertures; and from all doubts, ariſing from the different meaſure of ſpouting waters, aſſigned by different authors. On the other hand, the ſum of the weights raiſed by the action of this water, and of the weight required to overcome the friction and reſiſtance of the machine, multiplied by the height to which the weight can be raiſed in the time given, the product will be equal to the effect of that power; and the proportion of the two products will be the proportion of the power to the effect: ſo that by loading the wheel with different weights ſucceſſively, we ſhall be able to determine at what particular load, and velocity of the wheel, the effect is a maximum.

The manner of finding the real velocity of the water, at the inſtant of its ſtriking the wheel; the manner of finding the value of the friction, reſiſtance, &c. in any given caſe; and the manner of finding the real expence of water, ſo far as concerns the following experiments, without having recourſe to theory; being matters upon which the following determinations depend, it will be neceſſary to explain them.

To determine the Velocity of the Water ſtriking the Wheel.

It has already been mentioned, in the references to the figures, that weights are raiſed by a cord winding round a cylindrical part of the axis. Firſt, then, let the wheel be put in motion by the water, but without any weights in the ſcale; and let the number of turns in a minute be 60: now it is evident, that was the wheel free from friction and reſiſtance, that 60 times the circumference of the wheel would be the ſpace through which the water would have moved in a minute; with that velocity wherewith it ſtruck the wheel: but the wheel being incumbered by friction and reſiſtance, and yet moving 60 turns in a minute, it is plain that the velocity of the water muſt have been greater than 60 circumferences before it met with the wheel. Let now the cord be wound round the cylinder, but contrary to the uſual way, and put a weight in the ſcale; the weight ſo diſpoſed (which may be called the counter-weight) will endeavour to aſſiſt the wheel in turning the ſame way, as it would have been turned by the water: put therefore as much weight into the ſcale as, without any water, will cauſe it to turn ſomewhat faſter than at the rate of 60 turns in a minute; ſuppoſe 63: let it now be tried again by the water, aſſiſted by the weight; the wheel therefore will now make more than 60 turns; ſuppoſe 64: hence we conclude the water ſtill exerts ſome power in giving motion to the wheel. Let the weight be again increaſed, ſo as to make $64\frac{1}{2}$ turns in a minute without water: let it once more be tried with water as before; and ſuppoſe it now to make the ſame number of turns with water as without, viz. $64\frac{1}{2}$: hence it is evident, that in this caſe the wheel makes the ſame number of turns in a minute, as it would do if the wheel had no friction or reſiſtance at all; becauſe the weight is equivalent thereto; for was it too little, the water would accelerate the wheel beyond the weight; and if too great, retard it; ſo that the water now becomes a regulator of the wheel's motion; and the

the velocity of its circumference becomes a meaſure of the velocity of the water.

In like manner, in ſeeking the greateſt product, or maximum of effect; having found by trials what weight gives the greateſt product, by ſimply multiplying the weight in the ſcale by the number of turns of the wheel, find what weight in the ſcale, when the cord is on the contrary ſide of the cylinder, will cauſe the wheel to make the ſame number of turns the ſame way, without water; it is evident that this weight will be nearly equal to all friction and reſiſtance taken together; and conſequently, that the weight in the ſcale, with twice the weight of the ſcale, added to the back or counter-weight, will be equal to the weight that could have been raiſed, ſuppoſing the machine had been without friction or reſiſtance; and which multiplied by the height to which it was raiſed, the product will be the greateſt effect of that power.

The quantity of water expended is found thus:

The pump made uſe of for repleniſhing the head with water was ſo carefully made, that no water eſcaping back by the leathers, it delivered the ſame quantity of water at every ſtroke, whether worked quick or ſlow; and as the length of the ſtroke was limited, conſequently the value of one ſtroke (or on account of more exactneſs 12 ſtrokes) was known, by the height to which the water was thereby raiſed in the head; which being of a regular figure was eaſily meaſured. The ſluice, by which the water was drawn upon the wheel, was made to ſtop at certain heights by a peg; ſo that when the peg was in the ſame hole, the aperture for the effluent water was the ſame. Hence the quantity of water expended by any given head, and opening of the ſluice, may be obtained: for by obſerving how many ſtrokes a minute was ſufficient to keep up the ſurface of the water at the given height, and multiplying the number of ſtrokes by the value of each, the water expended by any given aperture and head in a given time will be given.

Theſe things will be further illuſtrated by going over the calculus of one ſett of experiments.

Specimen of a Sett of Experiments.

The ſluice drawn to the 1ſt hole.

The water above the floor of the ſluice — 30 inches.
Strokes of the pump in a minute —— $39\frac{1}{2}$
The head raiſed by 12 ſtrokes —— 21 inches.
The wheel raiſed the empty ſcale, and made turns in a minute —— —— —— } 80
With a counter-weight of 1 lb. 8 oun. it made —— —— —— —— —— —— } 85
Ditto tried with water 86

N°.	Weight		Turns in a min.		Product.
	lb.	*oz.*			
1	4	0	45		180
2	5	0	42		210
3	6	0	$36\frac{1}{4}$		$217\frac{1}{2}$
4	7	0	$33\frac{3}{4}$		$236\frac{1}{4}$
5	8	0	30		240 maximum.
6	9	0	$26\frac{1}{2}$		$238\frac{1}{2}$
7	10	0	22		220
8	11	0	$16\frac{1}{2}$		$181\frac{1}{2}$
9	12	ceaſed working.			

Counter weight, for 30 turns without water, 2 oz. in the ſcale.

N. B. The area of the head was 105,8 ſquare inches.
Weight of the empty ſcale and pulley, 10 oz.
Circumference of the cylinder, 9 inches.
Circumference of the water wheel, 75 ditto.

Reduction of the above Sett of Experiments.

The circumference of the wheel, 75 inches, multiplied by 86 turns, gives 6450 inches for the velocity of the water in a minute; $\frac{1}{60}$ of which will be the velocity in a ſecond, equal to 107,5 inches, or 8,96 feet, which is due to a head of 15 inches; and this we call the virtual or effective head.

The area of the head being 105,8 inches, this multiplied by the weight of water of the inch cubic, equal to the decimal, ,579 of the ounce averdupoiſe, gives 61,26 ounces for the weight of as much water, as is contained in the head, upon 1 inch in depth, $\frac{1}{16}$ of which is 3,83 pounds; this multiplied by the depth 21 inches, gives 80,43 lb. for the value of 12 ſtrokes; and by proportion, $39\frac{1}{2}$ (the number made in a minute) will give 264,7 lb. the weight of water expended in a minute.

Now as 264,7 lb. of water may be conſidered as having deſcended through a ſpace of 15 inches in a minute, the product of theſe two numbers 3970 will expreſs the power of the water to produce mechanical effects; which were as follows.

The velocity of the wheel at the maximum, as appears above, was 30 turns a minute; which multiplied by 9 inches, the circumference of the cylinder, makes 270 inches; but as the ſcale was hung by a pulley and double line, the weight was only raiſed half of this, viz. 135 inches.

The weight in the ſcale at the maximum	8 *lb.*	0 *oz.*
Weight of the ſcale and pulley ——	0	10
Counterweight, ſcale, and pulley ——	0	12
Sum of the reſiſtance —— ——	9	6
or *lb.*	9,375.	

Now as 9,375 lb. is raiſed 135 inches, theſe two numbers being multiplied together, the product is 1266, which expreſſes the effect produced at a maximum: ſo that the proportion of the power to the effect is as 3970: 1266, or as 10: 3,18.

But though this is the greateſt ſingle effect producible from the power mentioned, by the impulſe of the water upon an underſhot wheel; yet, as the whole power of the water is not exhauſted thereby, this will not be the true ratio between the power of the water, and the ſum of all the effects producible therefrom: for as the water muſt neceſſarily leave the wheel with a velocity equal to the wheel's circumference, it is plain that ſome part of the power of the water muſt remain after quitting the wheel.

The velocity of the wheel at the maximum is 30 turns a minute; and conſequently its circumference moves at the rate of 3,123 feet a ſecond, which anſwers to a head, 1,82 inches; this being multiplied by the expence of water in a minute, viz. 264,7 lb. produces 481 for the power remaining in the water after it has paſſed the wheel: this being therefore deducted from the original power 3970, leaves 3489, which is that part of the power which is ſpent in producing the effect 1266; and conſequently the part of the power ſpent in producing the effect, is to the greateſt effect producible thereby as 3489: 1266 :: 10: 3,62, or as 11 to 4.

The velocity of the water ſtriking the wheel has been determined to be equal to 86 circumferences of the wheel per minute, and the velocity of the wheel at the maximum to be 30; the velocity of the water will therefore be to that of the wheel as 86 to 30, or as 10 to 3,5, or as 20 to 7.

The load at the maximum has been ſhown to be equal to 9 lb. 6 oz. and that the wheel ceaſed moving with 12 lb. in the ſcale: to which if the weight of the ſcale is added, viz. 10 ounces, the proportion will be nearly as 3 to 4 between the load at the maximum and that by which the wheel is ſtopped.

It is ſomewhat remarkable, that though the velocity of the wheel in relation to the water turns out greater than $\frac{1}{3}$ of the velocity of the water, yet the impulſe of the water in the caſe of a maximum is more than double of what is aſſigned by theory; that is, inſtead of $\frac{4}{9}$ of the column, it is nearly equal to the whole column.

It muſt be remembered, therefore, that, in the preſent caſe, the wheel was not placed in an open river, where the natural current, after it has communicated its impulſe to the float, has room on all ſides to eſcape, as the theory ſuppoſes; but in a conduit or race, to which the float being adapted, the water cannot otherwiſe eſcape than by moving along with the wheel. It is obſervable, that a wheel working in this manner, as ſoon as the water meets the float, receiving a ſudden check, it riſes up againſt the float, like a wave againſt a fixed object; inſomuch that when the ſheet of water is not a quarter of an inch thick before it meets the float, yet this ſheet

will

will act upon the whole ſurface of a float, whoſe height is 3 inches; and conſequently was the float no higher than the thickneſs of the ſheet of water, as the theory alſo ſuppoſes, a great part of the force would have been loſt, by the water's daſhing over the float.

In further confirmation of what is already delivered, I have adjoined the following table, containing the reſult of 27 ſetts of experiments, made and reduced in the manner above ſpecified. What remains of the theory of underſhot wheels, will naturally follow from a compariſon of the different experiments together.

N°.	Height of the water in the ciſtern.	Turns of the wheel unloaded.	Virtual head deduced therefrom.	Turns at the maxim^m.	Load at the equilibrium.	Load at the maximum.	Water expended in a minute.	Power.	Effect.	Ratio of the power and effect.	Ratio of the velocity of the water and wheel.	Ratio of the load at the equilibrium, to the load at the maxim^m.	Experiments.
	Inc.		Inch.		lb. oz.	lb. oz.							
1	33	88	15,85	30,	13 10	10 9	275,	4358	1411	10 : 3,24	10 : 3,4	10 : 7,75	
2	30	86	15,0	30,	12 10	9 6	264,7	3970	1266	10 : 3,2	10 : 3,5	10 : 7,4	
3	27	82	13,7	28,	11 2	8 6	243,	3329	1044	10 : 3,15	10 : 3,4	10 : 7,5	
4	24	78	12,3	27,7	9 10	7 5	235,	2890	901,4	10 : 3,12	10 : 3,55	10 : 7,53	
5	21	75	11,4	25,9	8 10	6 5	214,	2439	735,7	10 : 3,02	10 : 3,45	10 : 7,32	
6	18	70	9,95	23,5	6 10	5 5	199,	1970	561,8	10 : 2,85	10 : 3,36	10 : 8,02	
7	15	65	8,54	23,4	5 2	4 4	178,5	1524	442,5	10 : 2,9	10 : 3,6	10 : 8,3	
8	12	60	7,29	22,	3 10	3 5	161,	1173	328	10 : 2,8	10 : 3,77	10 : 9,1	
9	9	52	5,47	19,	2 12	2 8	134,	733	213,7	10 : 2,9	10 : 3,65	10 : 9,1	
10	6	42	3,55	16,	1 12	1 10	114,	404,7	117	10 : 2,82	10 : 3,8	10 : 9,3	
11	24	84	14,2	30,75	13 10	10 14	342,	4890	1505	10 : 3,075	10 : 3,66	10 : 7,9	
12	21	81	13,5	29,	11 10	9 6	297,	4009	1223	10 : 3,01	10 : 3,62	10 : 8,05	
13	18	72	10,5	26,	9 10	8 7	285,	2993	975	10 : 3,25	10 : 3,6	10 : 8,75	
14	15	69	9,6	25,	7 10	6 14	277,	2659	774	10 : 2,92	10 : 3,62	10 : 9,	
15	12	63	8,0	25,	5 10	4 14	234,	1872	549	10 : 2,94	10 : 3,97	10 : 8,7	
16	9	56	6,37	23,	4 0	3 13	201,	1280	390	10 : 3,05	10 : 4,1	10 : 9,5	
17	6	46	4,25	21,	2 8	2 4	167,5	712	212	10 : 2,98	10 : 4,55	10 : 9,	
18	15	72	10,5	29,	11 10	9 6	357,	3748	1210	10 : 3,23	10 : 4,02	10 : 8,05	
19	12	66	8,75	26,75	8 10	7 6	330,	2887	878	10 : 3,05	10 : 4,05	10 : 8,1	
20	9	58	6,8	24,5	5 8	5 0	255,	1734	541	10 : 3,01	10 : 4,22	10 : 9,1	
21	6	48	4,7	23,5	3 2	3 0	228,	1064	317	10 : 2,66	10 : 4,9	10 : 9,6	
22	12	68	9,3	27,	9 2	8 6	359,	3338	1006	10 : 3,02	10 : 3,97	10 : 9,17	
23	9	58	6,8	26,25	6 2	5 13	332,	2257	686	10 : 3,04	10 : 4,52	10 : 9,5	
24	6	48	4,7	24,5	3 12	3 8	262,	1231	385	10 : 3,13	10 : 5,1	10 : 9,35	
25	9	60	7,29	27,3	6 12	6 6	355,	2588	783	10 : 3,03	10 : 4,55	10 : 9,45	
26	6	50	5,03	24,6	4 6	4 1	307,	1544	450	10 : 2,92	10 : 4,9	10 : 9,3	
27	6	50	5,03	26,	4 15	4 9	360,	1811	534	10 : 2,95	10 : 5,2	10 : 9,25	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	

At the 1ſt hole. At the 2d. The 3d. 4th. 5th. 6th.

Maxims and Obſervations deduced from the foregoing Table of Experiments.

Maxim I. That the virtual or effective head being the ſame, the effect will be nearly as the quantity of water expended.

This will appear by comparing the contents of the columns 4, 8, and 10, in the foregoing ſetts of experiments; as for

Example 1ſt, taken from N°. 8. *and* 25, viz.

N°.	Virtual Head.	Water expended.	Effect.
8	7,29	161	328
25	7,29	355	785

Now the heads being equal, if the effects are proportioned to the water expended, we ſhall have by maxim 1ſt, 161 : 355 :: 328 : 723; but 723 falls ſhort of 785, as it turns out in experiment according to N°. 25, by 62; the effect therefore of N°. 25, compared with N°. 8, is greater than according to the preſent maxim in the ratio of 14 to 13.

The foregoing example, with four ſimilar ones, are ſeen at one view in the following table.

Examples	N°. Tab. I.	Virtual Head.	Expence of Water.	Effect.	Compariſon.	Variation	Proportional Variation
		Inch.	lb.				
1ſt	8	7,29	161	328	161 : 355 :: 328 : 723	62+	14 : 13
	25	7,29	355	785			
2d	13	10,5	285	975	285 : 357 :: 975 : 1221	11−	121 : 122
	18	10,5	357	1210			
3d	22	6,8	255	541	255 : 332 :: 541 : 704	18−	38 : 39
	23	6,8	332	686			
4th	21	4,7	228	317	228 : 262 :: 317 : 364	21+	18 : 17
	24	4,7	262	385			
5th	26	5,03	307	450	307 : 360 :: 450 : 531	3+	178 : 177
	27	5,03	360	534			

Hence

Hence therefore, in comparing different experiments, as ſome fall ſhort, and others exceed the maximum, and all agree therewith, as near as can be expected, in an affair where ſo many different circumſtances are concerned; we may, according to the laws of reaſoning by induction, conclude the maxim true; viz. that the effects are nearly as the quantity of water expended.

Maxim II. That the expence of water being the ſame, the effect will be nearly as the height of the virtual or effective head.

This alſo will appear by comparing the contents of columns 4, 8, and 10, in an of the ſetts of experiments.

Example 1ſt, of N°. 2. *and* N°. 24. viz.

N°.	Virt. Head.	Expence.	Effect.
2	15	264,7	1266
24	4,7	262	385

Now as the expences are not quite equal, we muſt proportion one of the effects accordingly: thus

by maxim 1ſt, 262 : 264,7 :: 385 : 389
and by max. 2d, 15 : 4,7 :: 1266 : 397

Difference —— 8

The effect therefore of N°. 24. compared with N°. 2. is leſs than according to the preſent maxim in the ratio of 49 : 50.

The foregoing, and two other ſimilar examples, are compriſed in the following table.

Examples.	N°. Tab. I.	Virtual Head.	Expence of Water.	Effect.	Compariſon.	Variation.	Proportional Variation.
1ſt	2	15	264,7	1266	Max. 1ſt, 262 : 264,7 :: 385 : 319	8 —	49 : 50
	24	4,7	262	385	Max. 2d, 15 : 4,7 :: 1266 : 397		
2d	1	15,85	275	1411	Max. 1ſt, 114 : 275 :: 117 : 282	34—	8 : 9
	10	3,55	114	117	Max. 2d, 15,85 : 3,55 :: 1411 : 316		
3d	11	14,2	342	1505	Max. 1ſt, 167,5 : 342 :: 212 : 433	17—	25 : 26
	17	4,25	1675	212	Max. 2d, 14,2 : 4,25 :: 1505 : 450		

Maxim III. That the quantity of water expended being the ſame, the effect is nearly as the ſquare of its velocity.

This will appear by comparing the contents of columns 3, 8, and 10, in any of the ſetts of experiments; as for

Example 1ſt of N°. 2. *with* N°. 24. viz.

N°.	Turns in a min.	Expence.	Effect.
2	86	264,7	1266
24	48	262	385

The velocity being as the number of turns, we ſhall have,

by max. 1ſt, 262 : 264,7 :: 385 : 389
and by max. 3d, $\left\{\begin{matrix} 86^2 : 48^2 \\ 7396 : 2304 \end{matrix}\right\}$ :: 1266 : 394

Difference - - - 5

The effect therefore of N°. 24. compared with N°. 2 is leſs than by the preſent maxim in the ratio of 78 : 79.

The foregoing, and three other ſimilar examples, are compriſed in the following table.

Examples.	N°. Tab. I.	Turns in a Minute.	Expence of Water.	Effect.	Compariſon.	Variation.	Proportional Variation.
1ſt	2	86	264,7	1266	Max. 1ſt, 262 : 264,7 :: 385 : 389	5 —	78 : 79
	24	48	262	385	Max. 3d, $\left\{\begin{matrix} 86^2 : 48^2 \\ 7396 : 2304 \end{matrix}\right\}$ :: 1266 : 394		
2d	1	88	275	1411	Max. 1ſt, 114 : 275 :: 117 : 282	39—	7 : 8
	10	42	114	117	Max. 3d, $\left\{\begin{matrix} 88^2 : 42^2 \\ 7744 : 1764 \end{matrix}\right\}$ :: 1411 : 321		
3d	11	84	342	1505	Max. 1ſt, 167,5 : 342 :: 212 : 433	18—	24 : 25
	17	46	167,5	212	Max. 3d, $\left\{\begin{matrix} 84^2 : 46^2 \\ 7056 : 2116 \end{matrix}\right\}$ :: 1505 : 451		
4th	18	72	357	1210	Max. 1ſt, 228 : 357 :: 317 : 496	42—	12 : 13
	21	48	228	317	Max. 3d, $\left\{\begin{matrix} 72^2 : 48^2 \\ 5184 : 2301 \end{matrix}\right\}$ :: 1210 : 538		

Maxim 4th. The aperture being the ſame, the effect will be nearly as the cube of the velocity of the water.

This alſo will appear by comparing the contents of columns 3, 8, and 10; as for

Example 1ſt, of N°. 1. *and* N°. 10, viz.

N°.	Turns.	Expence.	Effect.
1	88	275	1411
10	42	114	117

Lemma. It muſt here be obſerved, that if water paſſes out of an aperture, in the ſame ſection, but with different velocities; the expence will be proportional to the velocity; and therefore converſely, if the expence is not proportional to the velocity, the ſection of the water is not the ſame.

Now comparing the water diſcharged with the turns of N°. 1, and 10, we ſhall have 88 : 42 :: 275 : 131,2; but the water diſcharged by N°. 10. is only 114 ℔; therefore, though the ſluice was drawn to the ſame height in N°. 10. as in N°. 1. yet the ſection of the water paſſing out, was leſs in N°. 10. than N°. 1. in the proportion of 114 to 131,2; conſequently had the effective aperture or ſection of the water been the ſame in N°. 10. as in N°. 1. ſo that if 131,2 ℔. of water had been diſcharged inſtead of 114, the effect would have been increaſed in the ſame proportion; that is,

by the lemma, 88 : 42 :: 275 : 131,2
by maxim 1ſt, 114 : 131,2 :: 117 : 134,5
and by max. 4th, $\left\{\begin{matrix} 83^3 : 42^3 \\ 681472 : 74088 \end{matrix}\right\}$ :: 1411 : 153,5

Difference —— 19

The effect therefore of N°. 10. compared with N° 1. is leſs than it ought to be by the preſent maxim in the ratio of 7 : 8.

The foregoing, and three other ſimilar examples, are contained in the following table.

Examples.	N°. Tab. I.	Turns in a minute.	Expence of Water.	Effect.	Comparison.	Variation.	Proportional Variation.
1st	1	88	275	1411	Lemma. 88 : 42 :: 275 : 131,2	19—	7 : 8
	10	42	114	117	Max. 1. 114 : 131,2 :: 117 : 134,5		
					Max. 4. 88^3 : 42^3 :: 1411 : 153,5		
2d	11	84	342	1505	Lemma. 84 : 46 :: 342 : 187,3	10—	23 : 24
	17	46	167,5	212	Max. 1. 167,5 : 187,3 :: 212 : 237		
					Max. 4. 84^3 : 46^3 :: 1505 : 247		
3d	18	72	357	1210	Lemma. 72 : 48 :: 357 : 238	24—	14 : 15
	21	48	228	317	Max. 1. 228 : 238 :: 317 : 331		
					Max. 4. 72^3 : 48^3 :: 1210 : 355		
4th	22	68	359	1006	Lemma. 68 : 48 :: 359 : 253,4	18+	20 : 19
	24	48	262	385	Max. 1. 262 : 253,4 :: 385 : 372		
					Max. 4. 68^3 : 48^3 :: 1006 : 354		

Observations.

Obſerv. 1ſt. On comparing column 2d and 4th, tab. I. it is evident, that the virtual head bears no certain proportion to the head of water; but that when the aperture is greater, or the velocity of the water iſſuing therefrom leſs, they approach nearer to a coincidence: and conſequently in the large openings of mills and ſluices, where great quantities of water are diſcharged from moderate heads, the head of water, and virtual head determined from the velocity, will nearly agree, as experience confirms.

Obſerv. 2d. Upon comparing the ſeveral proportions between the power and effect in column 11th, the moſt general is that of 10 to 3; the extremes 10 to 3,2 and 10 to 2,8; but as it is obſervable, that where the quantity of water, or the velocity thereof; that is, where the power is greateſt, the 2d term of the ratio is greateſt alſo: we may therefore well allow the proportion ſubſiſting in large works, as 3 to 1.

Obſerv. 3d. The proportions of velocities between the water and wheel in column 12, are contained in the limits of 3 to 1 and 2 to 1; but as the greater velocities approach the limit of 3 to 1, and the greater quantity of water approach to that of 2 to 1, the beſt general proportion will be that of 5 to 2.

Obſerv. 4th. On comparing the numbers in column 13, it appears, that there is no certain ratio between the load that the wheel will carry at its maximum, and what will totally ſtop it; but that they are contained within the limits of 20 to 19, and of 20 to 15; but as the effect approaches neareſt to the ratio of 20 to 15, or of 4 to 3, when the power is greateſt, whether by increaſe of velocity, or quantity of water, this ſeems to be the moſt applicable to large works: but as the load that a wheel ought to have, in order to work to the beſt advantage, can be aſſigned, by knowing the effect it ought to produce, and the velocity it ought to have in producing it; the exact knowlege of the greateſt load it will bear, is of the leſs conſequence in practice.

It is to be noted, that in all the examples under the three laſt of the four preceding maxims, the effect of the leſſer power falls ſhort of its due proportion to the greater, when compared by its maxim; except the laſt example of maxim 4th: and hence, if the experiments are taken ſtrictly, we muſt infer, that the effects increaſe and diminiſh in an higher ratio than thoſe maxims ſuppoſe: but as the deviation is not very conſiderable, the greateſt being about 1-8th of the quantity in queſtion; and as it is not eaſy to make experiments of ſo compounded a nature with abſolute preciſion; we may rather ſuppoſe, that the leſſer power is attended with ſome friction, or works under ſome diſadvantage, which has not been duly accounted for, and therefore we may conclude, that theſe maxims will hold very nearly, when applied to works in large.

After the experiments above mentioned were tried, the wheel, which had originally 24 floats, was reduced to twelve; which cauſed a diminution in the effect, on account of a greater quantity of water eſcaping between the floats and the floor; but a circular ſweep being adapted thereto, of ſuch a length, that one float entered the curve before the preceding one quitted it, the effect came ſo near to the former, as not to give hopes of advancing it by increaſing the number of floats beyond 24 in this particular wheel.

Concerning Overshot Wheels.

We now proceed to examine the power and application of water, when acting by its gravity on overſhot wheels.

In reaſoning without experiment, one might be led to imagine, that however different the mode of application is; yet that whenever the ſame quantity of water deſcends thro' the ſame perpendicular ſpace, that the natural effective power would be equal; ſuppoſing the machinery free from friction, equally calculated to receive the full effect of the power, and to make the moſt of it: for if we ſuppoſe the height of a column of water to be 30 inches, and reſting upon a baſe or aperture of one inch ſquare; every cubic inch of water that departs therefrom will acquire the ſame velocity or momentum, from the uniform preſſure of 30 cubic inches above it, that one cubic inch let fall from the top will acquire in falling down to the level of the aperture; viz. ſuch a velocity as in a contrary direction would carry it to the level from whence it fell; one would therefore ſuppoſe, that a cubic inch of water, let fall thro' a ſpace of 30 inches, and there impinging upon another body, would be capable of producing an equal effect by colliſion, as if the ſame cubic inch had deſcended thro' the ſame ſpace with a ſlower motion, and produced its effects gradually: for in both caſes gravity acts upon an equal quantity of matter, thro' an equal ſpace; and conſequently, that whatever was the ratio between the power and effect in underſhot wheels, the ſame would obtain in overſhot, and indeed in all others: yet, however concluſive this reaſoning may ſeem, it will appear, in the courſe of the following deductions, that the effect of the gravity of deſcending bodies is very different from the effect of the ſtroke of ſuch as are non-elaſtic, tho' generated by an equal mechanical power.

The alterations in the machinery already deſcribed, to accommodate the ſame for experiments on overſhot wheels, were principally as follows.

Plate CXXXVIII. *fig.* 3. The ſluice I *b* being ſhut down, the rod H I was unſcrewed and taken off.

The underſhot water-wheel was taken off the axis, and inſtead thereof an overſhot wheel of the ſame diameter was put into its place. Note, This wheel was two inches in the ſhroud or depth of the bucket; the number of the buckets was 36.

The ſtandards S and T, *fig.* 2, were raiſed half an inch, ſo that the bottom of the wheel might be clear of ſtagnant water.

A trunk, for bringing the water upon the wheel, was fixed according to the dotted lines *f g*, *fig.* 3. The aperture was adjuſted by a ſhuttle *h i*, which alſo cloſed up the outer end of the trunk, when the water was to be ſtopped.

Fig. 4. The rachet *o o*, not being of one piece of metal with the ferrule *e e*, *i i* (tho' ſo deſcribed before, to prevent unneceſſary diſtinctions), was with its catch turned the contrary ſide; conſequently the moveable barrel would do its office equally, notwithſtanding the water-wheel, when at work, moved the contrary way.

Specimen of a Sett of Experiments.

Head 6 inches.

14 ½ ſtrokes of the pump in a minute, 12 ditto = 80 lb.
Weight of the ſcale (being wet) 10½ oz.
Counterweight for 20 turns, beſides the ſcale, 3 oz.

N°.	Weight in the ſcale.	Turns.	Product.	Obſervations.
1	0 lb.	60		Threw moſt part of the water out of the wheel.
2	1	56		
3	2	52		
4	3	49	147	Received the water more quietly.
5	4	47	188	
6	5	45	225	
7	6	42 ½	255	
8	7	41	287	
9	8	38 ½	308	
10	9	36 ½	328 ½	
11	10	35 ½	355	
12	11	32 ¾	360 ½	
13	12	31 ¼	375	
14	13	28 ½	370 ½	
15	14	27 ½	385	
16	15	26	390	
17	16	24 ½	392	
18	17	22 ¾	386 ¾	
19	18	21 ¾	391 ½	
20	19	20 ¾	394 ¼	Maximum.
21	20	19 ¾	395	
22	21	18 ¼	388 ¼	
23	22	18	396	Worked irregular.
24	23	Overſet by its load.		

Reduction of the preceding Specimen.

In theſe experiments the head being 6 inches, and the height of the wheel 24 inches, the whole deſcent will be 30 inches: the expence of water was 14 ½ ſtrokes of the pump in a minute, whereof 12 contained 80 lb.; therefore the water expended in a minute was 96 ⅔ lb. which, multiplied by 30 inches, gives the power = 2900.

If we take the 20th experiment for the maximum, we ſhall have 20 ¾ turns in a minute, each of which raiſed the weight 4 ½ inches, that is, 93,37 inches in a minute. The weight in the ſcale was 19 lb. the weight of the ſcale 10 ½ oz.; the counter-weight 3 oz. in the ſcale, which, with the weight of the ſcale 10 ½ oz. makes in the whole 20 ½ lb. which is the whole reſiſtance or load: this, multiplied by 93,37 inches, makes 1914 for the effect.

The ratio therefore of the power and effect will be as 2900 : 1914, or as 10 : 6,6, or as 3 : 2 nearly.

But if we compute the power from the height of the wheel only, we ſhall have 96 ⅔ lb. multiplied by 24 inches = 2320 for the power, and this will be to the effect as 2320 : 1914, or as 10 : 82, or as 5 : 4 nearly.

The reduction of this ſpecimen is ſet down in N°. 9. of the following table; and the reſt were deducted from a ſimilar ſett of experiments, reduced in the ſame manner.

TABLE II. *Containing the reſult of Sixteen Setts of Experiments on Overſhot Wheels.*

N°.	Whole deſcent.	Water expended in a minute.	Turns at the maximum in a min.	Weight raiſed at the maximum.	Power of the whole deſcent.	Power of the wheel.	Effect.	Ratio of the whole power and effect.	Ratio of power of the wheel and effect.	Mean ratio.
	Inch.	*lb.*		*lb.*						
1	27	30	19	6 ½	810	720	556	10 : 6,9	10 : 7,7	10 : 8,1
2	27	56 ⅔	16 ¼	14 ½	1530	1360	1060	10 : 6,9	10 : 7,8	
3	27	56 ⅔	20 ¾	12 ½	1530	1360	1167	10 : 7,6	10 : 8,4	
4	27	63 ⅓	20 ½	13 ½	1710	1524	1245	10 : 7,3	10 : 8,2	
5	27	76 ⅔	21 ½	15 ½	2070	1840	1500	10 : 7,3	10 : 8,2	
6	28 ½	73 ⅓	18 ¾	17 ½	2090	1764	1476	10 : 7,	10 : 8,4	10 : 8,2
7	28 ½	96 ⅔	20 ¼	20 ½	2755	2320	1868	10 : 6,8	10 : 8,1	
8	30	90	20	19 ½	2700	2160	1755	10 : 6,5	10 : 8,1	10 : 8,2
9	30	96 ⅔	20 ¾	20 ½	2900	2320	1914	10 : 6,6	10 : 8,2	
10	30	113 ⅓	21	23 ½	3400	2720	2221	10 : 6,5	10 : 8,2	
11	33	56 ⅔	20 ¼	13 ½	1870	1360	1230	10 : 6,6	10 : 9,	10 : 8,5
12	33	106 ⅔	22 ¼	21 ½	3520	2560	2153	10 : 6,1	10 : 8,4	
13	33	146 ⅔	23	27 ½	4840	3520	2846	10 : 5,9	10 : 8,1	
14	35	65	19 ¾	16 ½	2275	1560	1466	10 : 6,5	10 : 9,4	10 : 8,5
15	35	120	21 ½	25 ½	4200	2880	2467	10 : 5,9	10 : 8,6	
16	35	163 ½	25	26 ½	5728	3924	2981	10 : 5,2	10 : 7,6	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11

Obſervations and Deductions from the foregoing Experiments.

I. *Concerning the Ratio between the Power and Effect of Overſhot Wheels.*

The effective power of the water muſt be reckoned upon the whole deſcent; becauſe it muſt be raiſed that height, in order to be in a condition of producing the ſame effect a ſecond time.

The ratio's between the powers ſo eſtimated, and the effects at the maximum deduced from the ſeveral ſetts of experiments, are exhibited at one view in column 9. of Table II. and from hence it appears, that thoſe ratio's differ from that of 10 to 7,6 to that of 10 : 5,2, that is, nearly from 4 : 3 to 4 : 2. In thoſe experiments where the heads of water and quantities expended are leaſt, the proportion is nearly as 4 : 3; but where the heads and quantities are greateſt, it approaches nearer to that of 4 : 2; and by a medium of the whole, the ratio is that of 3 : 2 nearly. We have ſeen before, in our obſervations upon the effects of underſhot wheels, that the general ratio

ratio of the power to the effect, when greateſt, was 3: 1; the effect therefore of overſhot wheels, under the ſame circumſtances of quantity and fall, is at a medium double to that of the underſhot: and, as a conſequence thereof, that non-elaſtic bodies, when acting by their impulſe or colliſion, communicate only a part of their original power; the other part being ſpent in changing their figure in conſequence of the ſtroke.

The powers of water computed from the height of the wheel only, compared with the effects, as in column 10. appear to obſerve a more conſtant ratio: for if we take the medium of each claſs, which is ſet down in column 11, we ſhall find the extremes to differ no more than from the ratio of 10: 8,1 to that of 10: 8,5; and as the ſecond term of the ratio gradually increaſes from 8,1 to 8,5, by an increaſe of head from 3 inches to 11, the exceſs of 8,5 above 8,1 is to be imputed to the ſuperior impulſe of the water at the head of 11 inches above that of 3 inches: ſo that if we reduce 8,1 to 8, on account of the impulſe of the 3 inch head, we ſhall have the ratio of the power, computed upon the height of the wheel only, to the effect at a maximum as 10: 8, or as 5: 4 nearly: and from the equality of the ratio between power and effect, ſubſiſting where the conſtructions are ſimilar, we muſt infer, that the effects, as well as the powers, are as the quantities of water and perpendicular heights multiplied together reſpectively.

II. *Concerning the moſt proper Height of the Wheel in proportion to the whole Deſcent.*

We have already ſeen, from the preceding obſervation, that the effect of the ſame quantity of water, deſcending thro' the ſame perpendicular ſpace, is double, when acting by its gravity upon an over-ſhot wheel, to what the ſame produces when acting by its impulſe upon an underſhot. It alſo appears, that by increaſing the head from 3 inches to 11, that is, the whole deſcent, from 27 inches to 35, or in the ratio of 7 to 9 nearly, the effect is advanced no more than in the ratio of 8,1 to 8,4, that is, as 7: 7,26; and conſequently the increaſe of effect as not 1-7th of the increaſe of perpendicular height. Hence it follows, that the higher the wheel is in proportion to the whole deſcent, the greater will be the effect; becauſe it depends leſs upon the impulſe of the head, and more upon the gravity of the water in the buckets: and if we conſider how obliquely the water iſſuing from the head muſt ſtrike the buckets, we ſhall not be at a loſs to account for the little advantage that ariſes from the impulſe thereof; and ſhall immediately ſee of how little conſequence this impulſe is to the effect of an overſhot wheel. However, as every thing has its limits, ſo has this: for thus much is deſirable, that the water ſhould have ſomewhat greater velocity, than the circumference of the wheel, in coming thereon; otherwiſe the wheel will not only be retarded, by the buckets ſtriking the water, but thereby daſhing a part of it over, ſo much of the power is loſt.

The velocity that the circumference of the wheel ought to have, being known by the following deductions, the head requiſite to give the water its proper velocity is eaſily computed from the common rules of hydroſtatics; and will be found much leſs than what is generally practiſed.

III. *Concerning the Velocity of the Circumference of the Wheel, in order to produce the greateſt Effect.*

If a body is let fall freely from the ſurface of the head to the bottom of the deſcent, it will take a certain time in falling; and in this caſe the whole action of gravity is ſpent in giving the body a certain velocity: but if this body in falling is made to act upon ſome other body, ſo as to produce a mechanical effect, the falling body will be retarded; becauſe a part of the action of gravity is then ſpent in producing the effect, and the remainder only giving motion to the falling body: and therefore the ſlower a body deſcends, the greater will be the portion of the action of gravity applicable to the producing a mechanical effect; and in conſequence the greater that effect may be.

If a ſtream of water falls into the bucket of an overſhot wheel, it is there retained till the wheel by moving round diſcharges it: of conſequence the ſlower the wheel moves, the more water each bucket will receive: ſo that what is loſt in ſpeed, is gained by the preſſure of a greater quantity of water acting in the buckets at once: and, if conſidered only in this light, the mechanical power of an overſhot wheel to produce effects will be equal, whether it moves quick or ſlow: but if we attend to what has been juſt now obſerved of the falling body, it will appear that ſo much of the action of gravity, as is employed in giving the wheel and water therein a greater velocity, muſt be ſubtracted from its preſſure upon the buckets; ſo that, though the product made by multiplying the number of cubic inches of water acting in the wheel at once by its velocity will be the ſame in all caſes; yet, as each cubic inch, when the velocity is greater does not preſs ſo much upon the bucket as when it is leſs, the power of the water to produce effects will be greater in the leſs velocity than in the greater: and hence we are led to this general rule, that, cæteris paribus, the leſs the velocity of the wheel, the greater will be the effect thereof. A confirmation of this doctrine, together with the limits it is ſubject to in practice, may be deduced from the foregoing ſpecimen of a ſett of experiments.

From theſe experiments it appears, that when the wheel made about 20 turns in a minute, the effect was, near upon, the greateſt. When it made 30 turns, the effect was diminiſhed about $\frac{1}{20}$ part; but that when it made 40, it was diminiſhed about $\frac{1}{4}$; when it made leſs than 18 $\frac{1}{4}$, its motion was irregular; and when it was loaded ſo as not to admit its making 18 turns, the wheel was overpowered by its load.

It is an advantage in practice, that the velocity of the wheel ſhould not be diminiſhed further than what will procure ſome ſolid advantage in point of power; becauſe, cæteris paribus, as the motion is ſlower, the buckets muſt be made larger; and the wheel being more loaded with water, the ſtreſs upon every part of the work will be increaſed in proportion: the beſt velocity for practice therefore will be ſuch, as when the wheel here uſed made about 30 turns in a minute; that is, when the velocity of the circumference is a little more than 3 feet in a ſecond.

Experience confirms, that this velocity of 3 feet in a ſecond is applicable to the higheſt overſhot wheels, as well as the loweſt; and all other parts of the work being properly adapted thereto, will produce very nearly the greateſt effect poſſible: however, this alſo is certain from experience, that high wheels may deviate further from this rule, before they will loſe their power, by a given aliquot part of the whole, than low ones can be admitted to do; for a wheel of 24 feet high may move at the rate of ſix feet per ſecond without loſing any conſiderable part of its power; and, on the other hand, I have ſeen a wheel of 33 feet high, that has moved very ſteadily and well with a velocity but little exceeding 2 feet.

IV. *Concerning the Load for an Overſhot Wheel, in order that it may produce a Maximum.*

The maximum load for an overſhot wheel, is that which reduces the circumferences of the wheel to its proper velocity; and this will be known, by dividing the effect it ought to produce in a given time by the ſpace intended to be deſcribed by the circumference of the wheel in the ſame time: the quotient will be the reſiſtance overcome at the circumference of the wheel; and is equal to the load required, the friction and reſiſtance of the machinery included.

V. *Concerning the greateſt poſſible Velocity of an Overſhot Wheel.*

The greateſt velocity that the circumference of an overſhot wheel is capable of, depends jointly upon the diameter or height of the wheel, and the velocity of falling bodies; for it is plain that the velocity of the circumference can never be greater, than to deſcribe a ſemi-circumference,

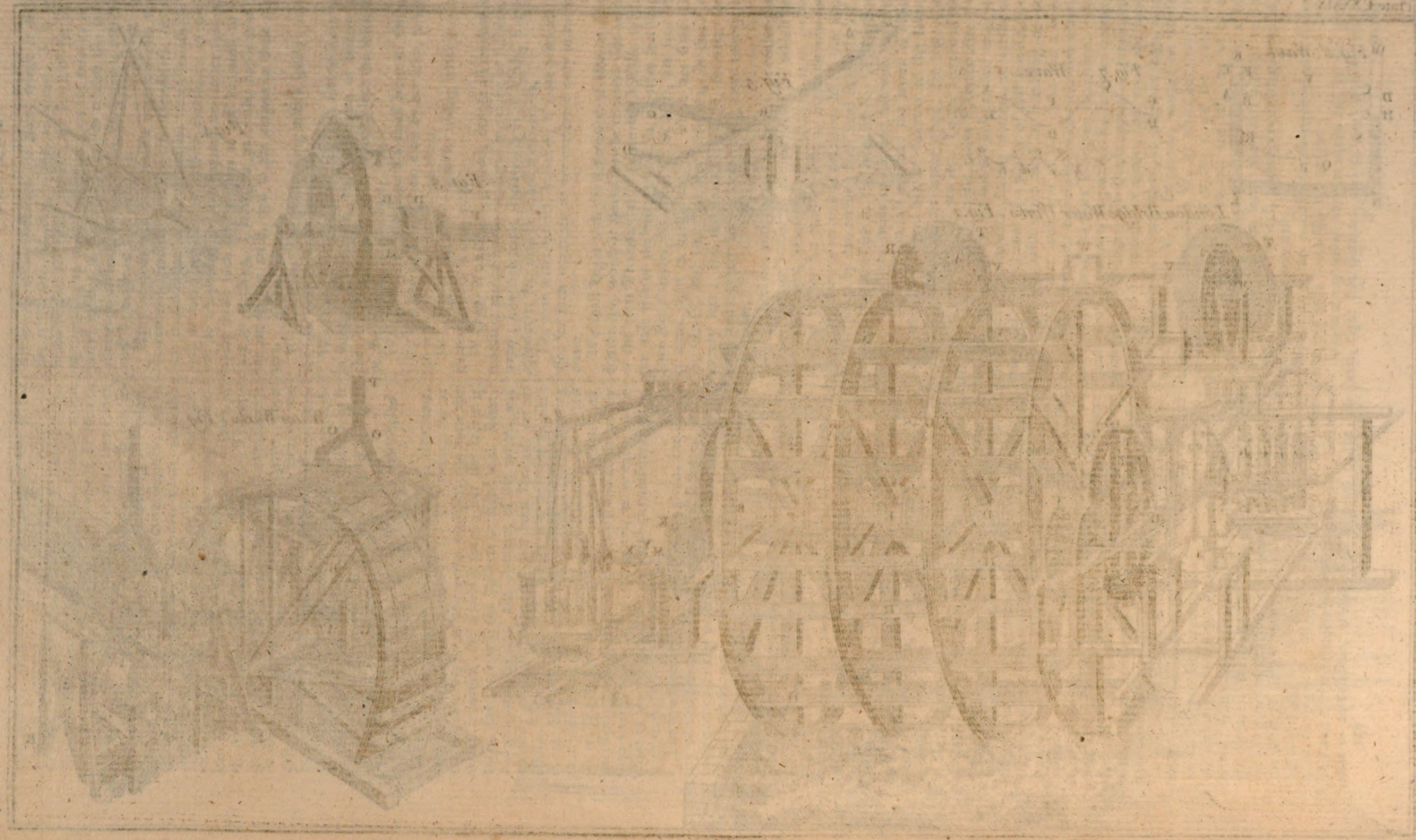


Fig. 6. Wave.

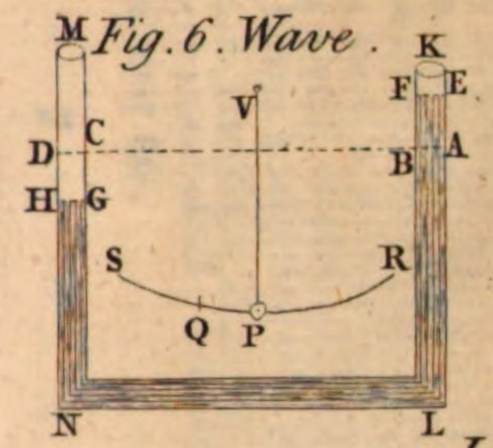
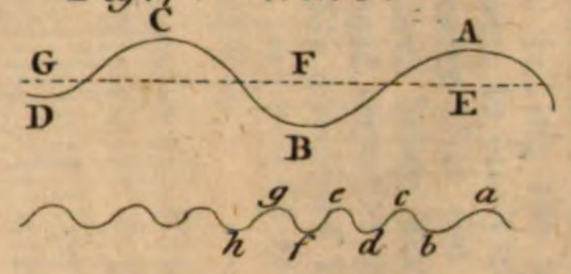
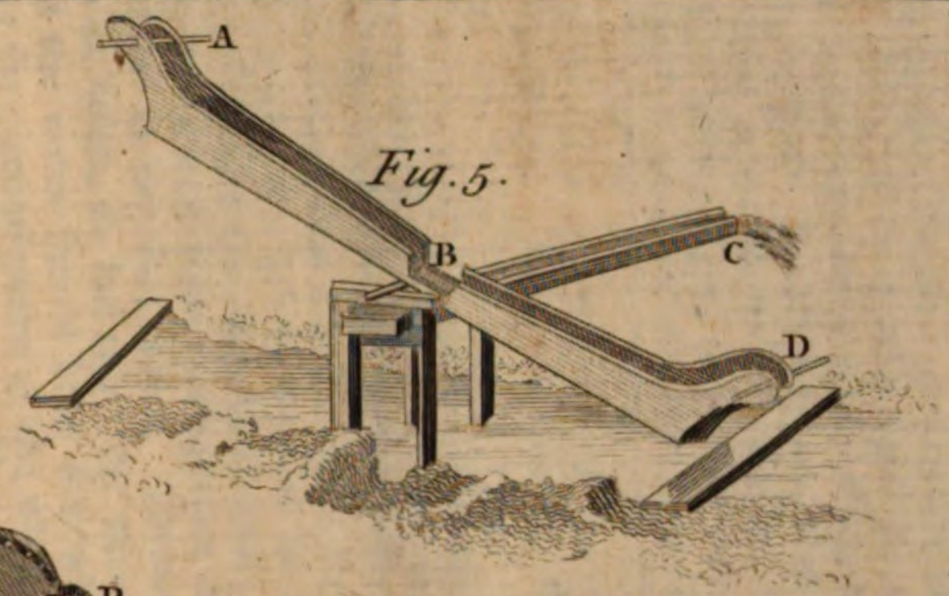
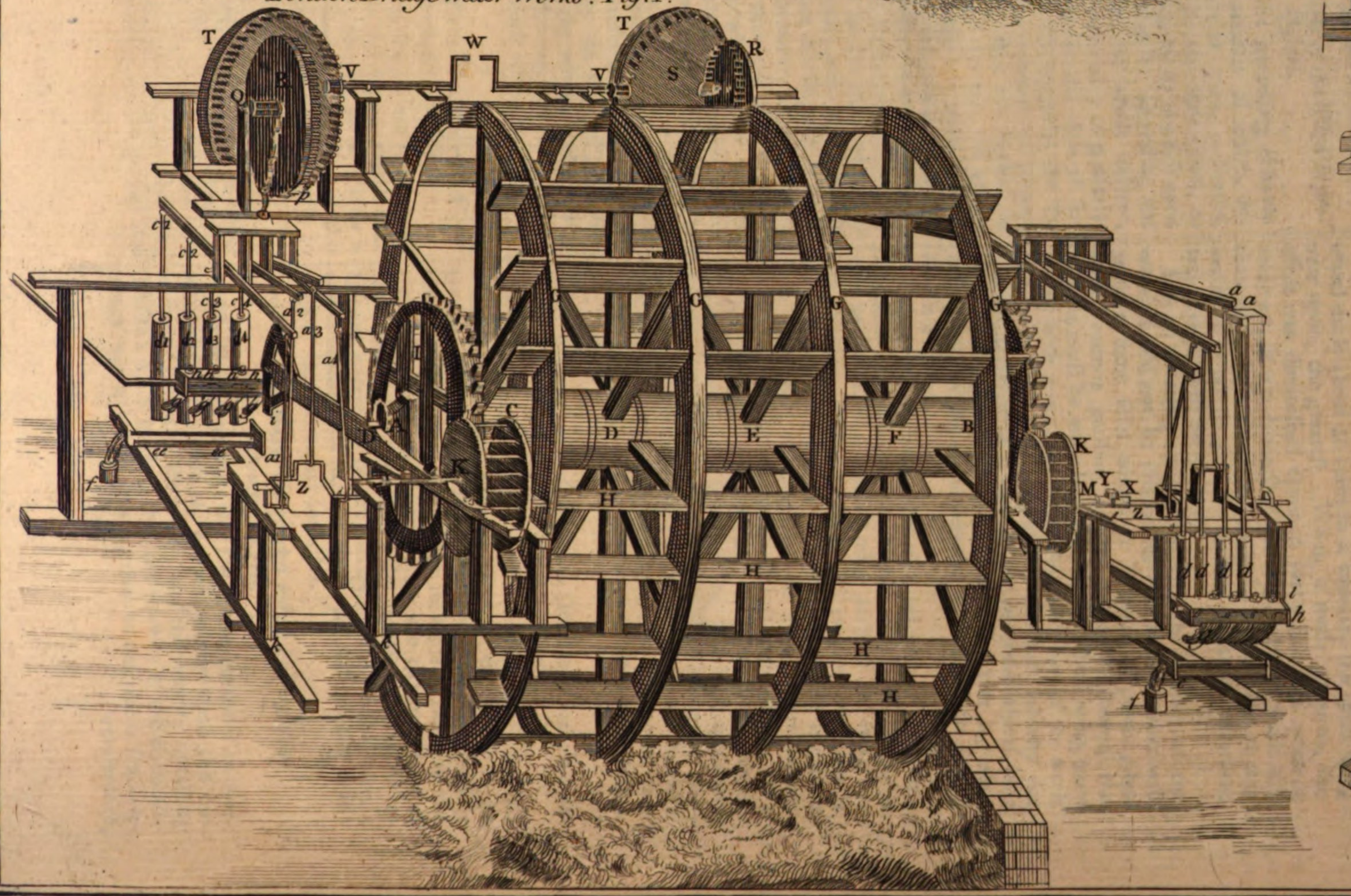


Fig. 7. Wave.





London Bridge Water Works. Fig. 1.



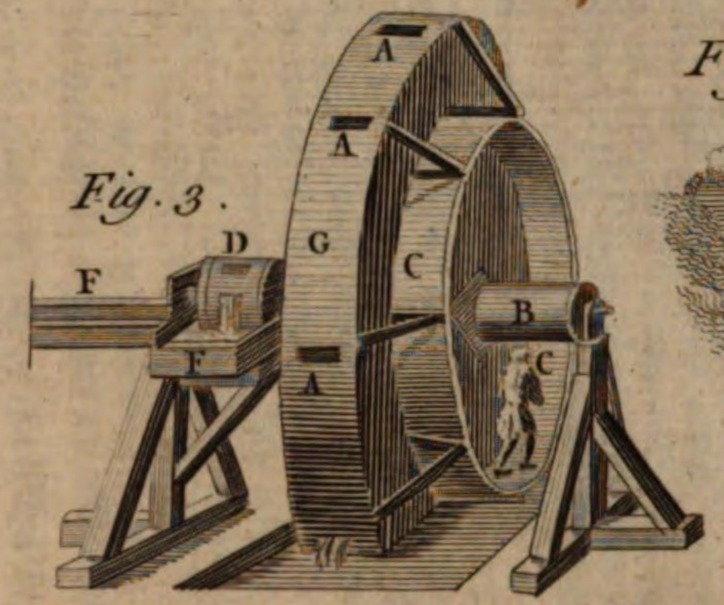
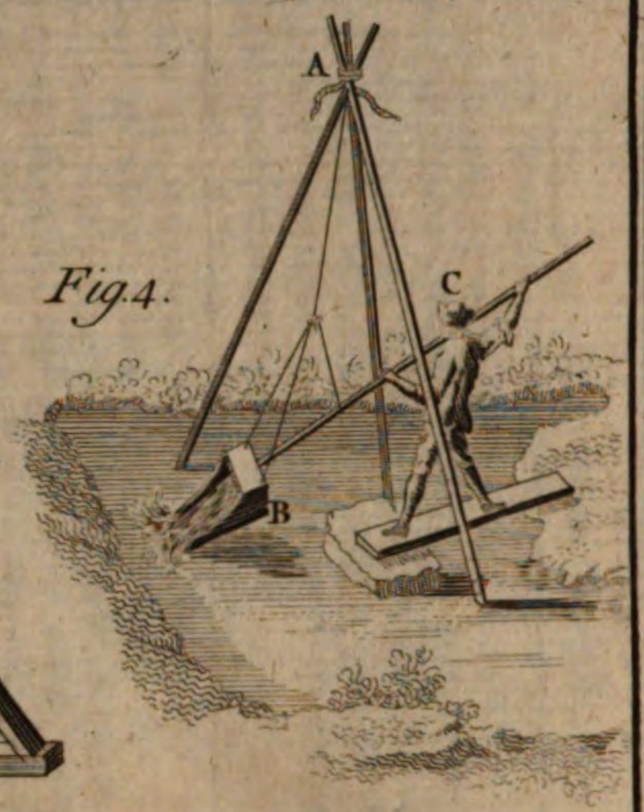
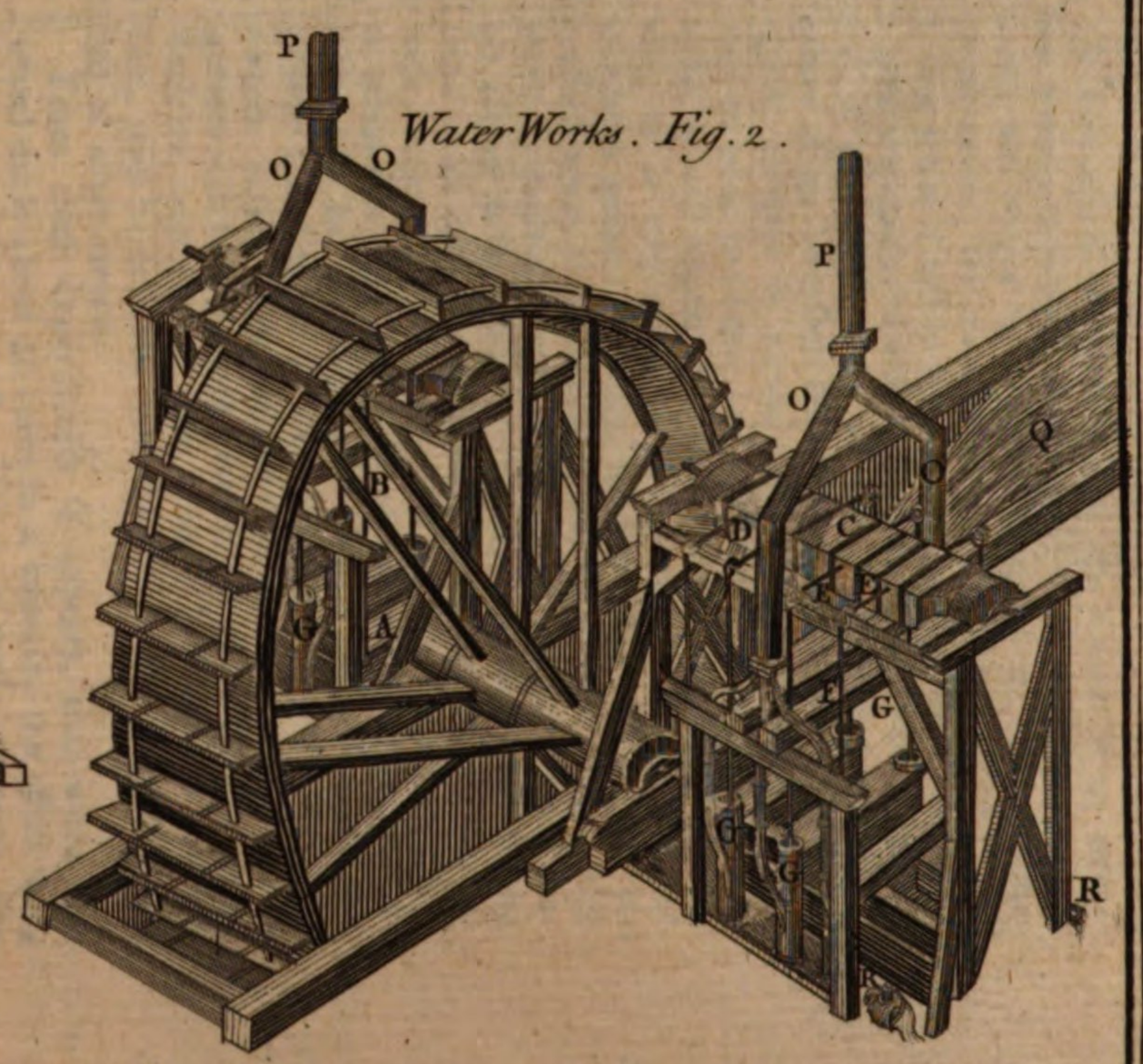


Fig. 3.

Fig. 4.



Water Works. Fig. 2.



cumference, while a body let fall from the top of the wheel will deſcend thro' its diameter; nor indeed quite ſo great, as a body deſcending through the ſame perpendicular ſpace cannot perform the ſame in ſo ſmall a time when paſſing through a ſemi-circle, as would be done in a perpendicular line. Thus, if a wheel is 16 feet 1 inch high, a body will fall through the diameter in one ſecond: this wheel therefore can never arrive at a velocity equal to the making one turn in two ſeconds; but in reality, an overſhot wheel can never come near this velocity; for when it acquires a certain ſpeed, the greateſt part of the water is prevented from entering the buckets; and the reſt, at a certain point of its deſcent, is thrown out again by the centrifugal force. This appears to have been the caſe in the three firſt experiments of the foregoing ſpecimen; but as the velocity, when this begins to happen, depends upon the form of the buckets, as well as other circumſtances, the utmoſt velocity of overſhot wheels is not to be determined generally: and, indeed, it is the leſs neceſſary in practice, as it is in this circumſtance incapable of producing any mechanical effect, for reaſons already given.

VI. *Concerning the greateſt Load that an overſhot-wheel can overcome.*

The greateſt load an overſhot wheel will overcome, conſidered abſtractedly, is unlimited or infinite: for as the buckets may be of any given capacity, the more the wheel is loaded, the ſlower it turns; but the ſlower it turns, the more will the buckets be filled with water; and conſequently tho' the diameter of the wheel, and quantity of water expended, are both limited, yet no reſiſtance can be aſſigned, which it is not able to overcome: but in practice we always meet with ſomething that prevents our getting into infiniteſimals; for when we really go to work to build a wheel, the buckets muſt neceſſarily be of ſome given capacity; and conſequently ſuch a reſiſtance will ſtop the wheel, as is equal to the effort of all the buckets in one ſemi-circumference filled with water.

The ſtructure of the buckets being given, the quantity of this effort may be aſſigned; but is not of much conſequence to the practice, as in this caſe alſo the wheel loſes its power; for though here is the exertion of gravity upon a given quantity of water, yet being prevented by a counterbalance from moving, is capable of producing no mechanical effect, according to our definition. But, in reality, an overſhot wheel generally ceaſes to be uſeful before it is loaded to that pitch; for when it meets with ſuch a reſiſtance as to diminiſh its velocity to a certain degree, its motion becomes irregular; yet this never happens till the velocity of the circumference is leſs than two feet per ſecond, where the reſiſtance is equable, as appears not only from the preceding ſpecimen, but from experiments on larger wheels.

Having now examined the different effects of the power of water, when acting by its impulſe, and by its weight, under the titles of underſhot and overſhot wheels; we might naturally proceed to examine the effects when the impulſe and weight are combined, as in the ſeveral kinds of breaſt-wheels, &c. but, what has been already delivered being carefully attended to, the application of the ſame principles in theſe mixt caſes will be eaſy, and reduce what I have to ſay on this head into a narrow compaſs: for all kinds of wheels where the water cannot deſcend thro' a given ſpace, unleſs the wheel moves therewith, are to be conſidered of the nature of an overſhot wheel, according to the perpendicular height that the water deſcends from; and all thoſe that receive the impulſe or ſhock of the water, whether in an horizontal, perpendicular, or oblique direction, are to be conſidered as underſhots. And therefore a wheel, which the water ſtrikes at a certain point below the ſurface of the head, and after that deſcends in the arch of a circle, preſſing by its gravity upon the wheel; the effect of ſuch a wheel will be equal to the effect of an underſhot, whoſe head is equal to the difference of level between the ſurface of the water in the reſervoir and the point where it ſtrikes the wheel, added to that of an overſhot, whoſe height is equal to the difference of level, between the point where it ſtrikes the wheel and the level of the tail-water. It is here ſuppoſed that the wheel receives the ſhock of the water at right angles to its radii; and that the velocity of its circumference is properly adapted to receive the utmoſt advantage of both theſe powers; otherwiſe a reduction muſt be made on that account.

Many obvious and conſiderable improvements upon the common practice naturally offer themſelves, from a due conſideration of the principles here eſtabliſhed, as well as many popular errors ſhew themſelves in view: but as my preſent purpoſe extends no farther than the laying down ſuch general rules as will be found to anſwer in practice, I leave the particular application to the intelligent artiſt, and to the curious in theſe matters.

WATER-SHOOT, a young ſprig which ſprings out of the root or ſtock of a tree.

WATER-TABLE, in architecture, a ſort of ledge left in ſtone, or brick-walls, about eighteen or twenty inches from the ground, from which place the thickneſs of the wall begins to abate.

WATER-WAY, in a ſhip, is a ſmall ledge of timber, lying fore and aft on the deck, cloſe by her ſides, to keep the water from running down there.

WATER-WHEEL, an engine for raiſing water in great quantity out of a deep well.

WATER-WORKS, in general, denote all manner of machines moved by, or employed in raiſing or ſuſtaining water; in which ſenſe, water-mills of all kinds, ſluices, aqueducts, &c. may be called water-works.

The term water-works, however, is more particularly uſed for ſuch machines as are employed only in raiſing water.

We ſhall begin with the deſcription of that at London-bridge, which is moved by the common tide-water of the river Thames. A B (plate CXXXIX. *fig.* 1.) the axle-tree of the water-wheel, is nineteen feet long, three feet diameter, in which C, D, E, F, are four ſets of arms, eight in each place, on which are fixed G, G, G, G, four rings, or ſets of felloes, in diameter twenty feet; and the floats H, H, H, fourteen feet long, and eighteen inches deep, being about twenty-ſix in number.

The wheel lies with its two gudgeons, or center-pins A B, upon two braſſes in the pieces M N, which are two great levers, whoſe fulcrum, or prop, is an arched piece of timber L: the levers being made circular on their lower ſides to an arch of the radius M O, and kept in their places by two arching ſtuds fixed in the ſtock L, through two mortiſes in the lever M N. The wheel is, by theſe levers, made to riſe and fall with the tide, which is performed in this manner: the levers M N are ſixteen feet long; from M, the fulcrum of the lever, to O the gudgeon of the water-wheel, ſix feet; and from O to the arch at N, ten feet. To the bottom of the arch N is fixed a ſtrong triple chain P, made after the faſhion of a watch-chain, but the links arched to a circle of one foot diameter, having notches, or teeth, to take hold of the leaves of a pinion of caſt iron Q, ten inches diameter, with eight teeth in it moving on an axis. The other looſe end of this chain has a large weight hanging at it, to help to counterpoiſe the wheel, and preſerve the chain from ſliding on the pinion. On the ſame axis is fixed a cog-wheel R, ſix feet diameter, with forty-eight cogs. To this is applied a trundle, or pinion S, of ſix rounds, or teeth; and upon the ſame axis is fixed T, a cog-wheel of fifty-one cogs, into which the trundle V, of ſix rounds, works; on whoſe axis is a winch or windlaſs W, by which one man, with the two windlaſſes, raiſes or lets down the wheel, as there is occaſion. And becauſe the fulcrums of theſe leaves M N are in the axis of the trundle K, viz. at M or X, in what ſituation ſoever the wheel is raiſed or let down, the cog-wheel I, I, is always equidiſtant from M, and works or geers truly.

By means of this machine the ſtrength of an ordinary man will raiſe about fifty ton weight.

I, I, is a cog-wheel fixed near the end of the great axis, eight feet diameter, and 44 cogs working into a

trundle K, of 4 ½ feet diameter, and 20 rounds, whoſe axis or ſpindle is of caſt iron 4 inches in diameter, lying in braſſes at each end, as at X.

ZZ is a quadruple crank of caſt iron, the metal being ſix inches ſquare, each of the necks being turned one foot from the center, which is fixed in braſſes at each end in two head-ſtocks faſtened down by caps. One end of this crank at Y is placed cloſe abutting to the end of the axle-tree X, where they are at thoſe ends ſix inches diameter, each having a ſlit in the ends, where an iron wedge is put, one half into the end X, the other half into Y, by means of which the axis X turns about the crank ZZ.

The four necks of the crank have each an iron ſpear, or rod, fixed at their upper ends to the reſpective libra, or lever, *a* 1, 2, 3, 4, within three feet of the end. Theſe levers are twenty-four feet long, moving on centers in the frame *bbbb*; at the end of which, at *c* 1, 2, 3, 4, are jointed four rods with their forcing plugs working into *d* 1, 2, 3, 4, four caſt iron cylinders four feet three quarters long, ſeven inches bore above, and nine below where the valves lie, faſtened by ſcrewed flanches over the four holes of a hollow trunk of caſt iron having four valves in it juſt over *eeee*, at the joining on at the bottom of the barrels, or cylinders, and at one end a ſucking pipe or grate *f*, going into the water, which ſupplies all the four cylinders alternately.

From the lower part of the cylinders *d* 1, *d* 2, *d* 3, *d* 4, come out necks turning upward arch-wiſe, as *gggg*, whoſe upper parts are caſt with flanches to ſcrew up to the trunk *hhhh*; which necks have bores of ſeven inches diameter, and holes in the trunk above communicating with them, at which joining are placed four valves. The trunk is caſt with four boſſes, or protuberances, ſtanding out againſt the valves to give room for their opening and ſhutting; and on the upper ſide are four holes ſtopped with plugs, to take out on occaſion, to cleanſe the valves. One end of this trunk is ſtopped by a plug *i*. To the other iron pipes are joined, as *i* 2, by flanches, through which the water is forced up to any height or place required.

Beſides theſe four forces, there are four more placed at the other ends of the libræ, or levers (not ſhewn here to avoid confuſion, but to be ſeen on the left hand) the rods being fixed at *a* 1, 2, 3, 4, working in four cylinders, with their parts *d d*, &c. *e e*, *f*, *g g* and *i*, as before deſcribed, ſtanding near *k k*.

At the other end of the wheel (at B) is placed all the ſame ſort of work as at the end A is deſcribed, viz.

The cog-wheel I.
The trundle K.
The ſpindle X.
The crank Y, Z.
The ſucking pipes *f*.
The four levers *a c*, *a c*, &c.
Eight forcing rods, *a d*, *a d*, &c.
Eight cylinders, *d e*, *d e*, &c.
Four trunks, ſuch as *e e*, *h h*.
Two forcing pipes, as *i*.

So that one ſingle wheel works 16 pumps. All which work could not be drawn in one perſpective view, without making it very much confuſed.

A Calculation of the Quantity of WATER *raiſed by the Engines at London Bridge.*

In the firſt arch next the city is one wheel with double work of		16 forcers.
In the third arch	Firſt wheel double work at one end, and ſingle at the other	12
	Second wheel in the middle	8
	Third wheel	16
	In all	52 forcers.
One revolution of a wheel makes in every forcer		2 ⅕ ſtrokes.
So that one turn of the four wheels makes		114 ſtrokes.
When the river is at beſt, the wheels go ſix times round in a minute, and but 4½ at middle water		6
The number of ſtrokes in a minute		684
The ſtroke is 2 ½ feet in a ſeven inch bore, raiſes		3
They raiſe per minute		2052 ale gallons.

That is, 123120 gallons = 1954 hogſheads per hour, and at the rate of 46896 hogſheads in a day, to the height of 120 feet.

This is the utmoſt quantity they can raiſe, ſuppoſing there were no imperfections or loſs at all.

But it is certain, from the conſiderations following, that no engine can raiſe ſo much as will anſwer the quantity of water the cylinder contains in the length of the forcers, or piſtons motion. For,

Firſt, opening and ſhutting of the valves loſe nearly ſo much of that column, as the height they riſe and fall.

Secondly, no leather is ſtrong enough for the piſton, but there muſt continually ſlip, or ſqueeze by, ſome water, when it is raiſed to a great height; and, when the column is ſhort, it will not preſs the leather enough to the cylinder, or barrel: but, eſpecially at the beginning or firſt moving of the piſton, there is ſo little weight on it, that, before the leather can expand, there is ſome loſs.

Thirdly, and this loſs is more or leſs, as the piſtons are looſer or ſtraiter leathered.

Fourthly, when the leathers grow too ſoft, they are not capable of ſuſtaining the pillar to be raiſed.

Fifthly, if they are leathered very tight, ſo as to loſe no water, then a great part of the engine's force is deſtroyed by friction.

By ſome experiments accurately made on engines, whoſe parts are large and excellently performed, they will loſe one fifth, and ſometimes one fourth of the calculated quantity.

However, the perfections or errors of engines are to be compared together, by the calculated quantities of forcers; for as they differ in thoſe, they will proportionably differ in their actual performances.

The Power by which the Wheels are moved.

The weight of the pillar of water on a forcer ſeven inches diameter and 120 feet high.

7 × 7 = 49 ℔. The pounds avoirdupoiſe in a yard, nearly.
40 yards high.

1960 ℔. on one forcer.
8 forcers always lifting.

The whole weight 15680 ℔. = 140 Cwt. = 7 ton weight on the engine at once.

Then

Then the crank pulls the libra 3 feet from the forcer, and 8,3 feet from the center,

7 ton
× 11.3

8,3)79.1(9,5. ton on the crank

Wallower — — — 2,2)9,5(4,3 ton on trundle
The ſpur wheel — — — 4

Radius of the great wheel — 10)17,2(1,72 ton
20

The force on the floats 18 Cwt. 40 lb. 34,40 Cwt.
But to allow for friction and velocity, may be reckoned 1 ton ½.
The ladles, or paddles, 14 feet long, 18 inches deep, = 22,4 ſquare feet.
The fall of water is at a mean — — — — — 2 feet
44,8
6 gallons in a cubic foot.
268,8
10, lb. in a gallon.
112)2688(24 hundred.

The velocity of the water, 4 feet in 21‴ of time.
21‴—4 feet::—60″ : =685 feet per minute.
The velocity of the wheel = 310 feet per minute.
Quantity expended on the wheel, according to the velocity of the ſtream, 1433 hogſheads per ſecond.
But at the velocity of the wheel 645 hogſheads per ſecond.
The velocity of the wheel to the velocity of the water, as 1 to 2,2.

Fig. 2. plate CXXXIX. repreſents a curious machine for raiſing water, executed at Nynphenbourg, by the count de Whal, maſter of the works to the elector of Bavaria. It raiſes water ſixty feet high into a reſervoir, for the uſe of the elector's gardens.

The water of the canal, falling down the inclined plane at Q, turns the large wheel repreſented in the figure, the circumference of which, by cogs, moves the arbor D, and the ſame on the other ſide; to thoſe are faſtened the piſtons of ſixteen forcing pumps G, four on each ſide the arbor, as repreſented in the figure.

From each of theſe pumps is a tube, through which the water is forced into the pipe O, and from thence through the pipe P, which conveys it into the reſervoir. Theſe pumps are faſtened together by pieces of timber, with iron clamps, to make them firm, as may be ſeen in the figure.

This is a very good machine, and deſerves to be imitated, either in whole or in part, when water is to be raiſed.

We ſhall conclude this account of water-works with a deſcription of two machines much uſed in Holland.

Fig. 3. repreſents another machine for raiſing water: it is moved by the man C, walking in the wheel C, as is plain from the figure. The large wheel A, A, G, has ſeven ſquare holes in its circumference, as A, A, A, which run in a ſpiral form to the axis B. The water, by the motion of the wheel whoſe circumference is conſtantly immerſed in it, runs along theſe ſpiral tubes to the axis; from whence it is conveyed to D, where it is diſcharged, and by means of the trough and ſpout F, F, conveyed to the reſervoir deſtined to receive it.

Fig. 4. repreſents a machine uſed by the Dutch for freeing their dykes of water. It conſiſts of five pieces of board, forming a kind of ſcoop, as B; the handle C is ſuſpended by a rope faſtened to three poles placed triangularly, and faſtened together at A, as is plain from the figure. As the working of this machine conſiſts in balancing it, and directing it ſo that, after having filled it with water, it may throw it on the other ſide of the dam, we ſhall only obſerve that the labourer at two ſtrokes can draw only half a cubic foot of water in four ſeconds, which amounts to four hundred cubic feet in an hour.

Fig. 5. is another machine of the ſame kind with that above deſcribed. The figure ſufficiently explains its uſe. It is worked by two men, one at A, and another at D. The machine moves on the center B, and each end is immerſed alternately in the water; by which means it flows into each end of the machine where there is a valve, to prevent its returning; and, by the alternate motion of the machine, the water ſo taken up is conveyed to B, and from thence, by the ſpout C, over the dam.

WATERING, in the manufactures, is to give a luſtre to ſtuffs, &c. by wetting them lightly with gum-water, and then paſſing them through the preſs, or calendar, whether hot or cold.

The gum-water ought to be pure, thin, and clear, otherwiſe the folds of the ſtuff will ſtick together: the operation muſt alſo be performed when the water is very hot, that it may penetrate.

WAVE, *Unda*, in philoſophy, a cavity in the ſurface of water, or other fluid, with an elevation aſide thereof.

Sir Iſaac Newton explains the nature of waves in water after the following manner: Let AB and CD (plate CXXXIX. *fig.* 6.) be the ſurface of water quieſcent in the upright legs KL, MN, of a received tube. And if the water be put into motion, and aſcends in the leg KL to EF, it will deſcend in the leg MN to GH; ſo that EA=DH. Again, let PV be a pendulum vibrating in the cycloid RPS, its length VP, from the point of ſuſpenſion to the center of oſcillation, is equal to half the length of the water in the tube; let P be the loweſt point, and PQ an arch of the cycloid, equal to the altitude AE.

The force by which the water is alternately accelerated and retarded in its motion in the tube, is the exceſs of the weight of water in either leg above the weight in the other; and, therefore, when the water in the leg KL aſcends to EF, and in the other leg deſcends to GH, that force is equal to the weight of the two equal quantities of water AEFB+CGHD = 2AEFB; and, therefore, is to the weight of the whole water, as EA to VP, or as PQ to PR, becauſe the ſemi-cycloid PR is equal to the length of the pendulum, which deſcribes it from the nature of the curve.

All the power by which the weight P is in any point Q accelerated or retarded in the cycloid, is, to its whole weight, as the diſtance PQ from the loweſt point P to the length of the ſemi-cycloid PR. Wherefore, as the moving forces of the water and pendulum are at firſt quieſcent, thoſe powers will move them equally in equal times, and cauſe that they go forwards and backwards together, with a reciprocal motion. All which is eaſily deduced, from what has been ſaid of the nature of the cycloid, the motion of heavy bodies, and the forces of bodies in motion.

Hence it follows, that, whether the diſtance AE be great or ſmall, the reciprocations of the water will all be performed

performed in equal times. Alſo, it follows, that if the whole length of the water be 78,4 inches, each reciprocation, or aſcent and deſcent of the water, will be performed in one ſecond of time; becauſe a pendulum of half that length vibrates in that time. Laſtly, if the length of the aqueous canal be increaſed or diminiſhed, the time of each reciprocation will be increaſed or diminiſhed in the ſubduplicate ratio of the length.

When the nature of waves in water is conſidered, it will be found to agree very nearly with the motion of the water in the tube abovementioned; and, conſequently, their motion will be ſimilar to that of a pendulum. For let E F G (*fig.* 7.) repreſent the level ſurface of water when it is not agitated, ſo as to produce waves; when it is thus agitated, let A B C D repreſent the wavy ſurface, A C the higheſt parts of the waves, and B D the loweſt or concave part. Then it is evident, the weight of the water at A above E G will cauſe it to deſcend as far below the level to B; and with the motion acquired by that deſcent, it will again aſcend to the ſame height C, and ſo produce a conſtant ſucceſſion of waves in the watery ſurface, after the ſame manner as was ſhewn in the tube.

Hence it follows, that becauſe the length of the whole water to be moved is from the higheſt point A to the loweſt point B, if the length of a pendulum be half A B, it will oſcillate once while the water deſcends from A to B, and in another oſcillation, it will aſcend from B to C, and ſo on. So that a wave will paſs through its whole length in the time of two oſcillations; and, therefore, in the time of one oſcillation of a pendulum four times as long, or equal to A B C.

Whence, becauſe A B C, in very large and wide waves, is nearly equal to the breadth A C; therefore, when the waves are 39,2 inches broad, they will undulate in one ſecond of time; and, conſequently, ſince the times of all the undulations are equal, there will be $39{,}2 \times 60 = 2352$ inches or 196 feet, run through by a wave in one minute, which is 11760 feet per hour. Hence, alſo the velocity of greater or leſſer waves will be increaſed or diminiſhed in the ſubduplicate proportion of their breadth; that is, if $V =$ velocity of the greater waves A B C D, and $v =$ velocity of the leſſer waves *a*, *b*, *c*, *d*, *e*, *f*, &c. then it will be $V : v :: \sqrt{AC} : \sqrt{ac}$. Becauſe the velocities and times of bodies, moved in any manner by gravity, are proportional to the ſquare roots of the perpendicular altitudes, and thoſe altitudes are as the lengths of pendulums, and, therefore, as the breadth of waves.

WAVE-OFFERING, in Jewiſh antiquity, a ſacrifice offered by agitation, or waving, towards the four cardinal points of the compaſs.

WAVED, WAVY, or WAVEY, in heraldry, is ſaid of a bordure, or any ordinary, or charge, in a coat of arms, having its out-lines indented in manner of the riſing and falling of waves; it is uſed to denote, that the firſt of the family in whoſe arms it ſtands, acquired its honours for ſea-ſervice.

WAVING, in the ſea-language, is the making ſigns to a veſſel to come near or keep off.

WAX, or *Bees*-WAX, is one of the products of the bee-hive, which, though it is, as well as the honey, of a vegetable origin, yet, as we have no way of procuring it but by means of the bees that have ſtored it up for us, is to be reckoned in the ſame manner as the honey among the number of drugs which we receive from the animal kingdom.

Wax is a firm and ſolid ſubſtance, moderately hard, and of a fine yellow colour; it melts with a gentle heat, and is inflammable; it is ſoluble in oil, but not in aqueous or ſpirituous menſtruums; it is almoſt inſipid to the taſte, but of a fragrant and agreeable ſmell; and, in its original ſtate, is the matter which compoſes the honeycomb; it is prepared in the cakes we ſee it in, merely by melting, and ſtraining through a cloth, which ſeparates the droſs and foulneſs, and lets the clear wax through. It may be further purified by melting again, and ſcumming it, while in fuſion, and repeating the ſtraining; by this means it will become of a good conſiſtence, and high colour; it is to be choſen of a ſtrong yellow colour, and fragrant ſmell; and ſuch as breaks tolerably eaſy, and on chewing in the mouth, does not ſtick to the teeth.

The true origin of wax is this: the flowers of plants have, for one of their principal and eſſential parts, certain filaments, or threads, called by the botanical writers, ſtamina, riſing uſually from the baſe or center; theſe are different in number, from one to a vaſt abundance in each flower: theſe ſuſtain at their tops certain little bodies, uſually of a round, but ſometimes of other figures, called by the ſame authors apices, or antheræ, and containing a fine duſty matter, or variouſly coloured powder. Theſe ſtamina and apices were long eſteemed of very little uſe to the plant, mere ornaments, or the receptacles of an abundant juice ſent up the flower; but of late, botany has received too many improvements to be left chargeable with ſo groſs an error: theſe are diſcovered to be eſſential to the great end, the propagating the ſpecies of the plant; they are, indeed, the male plants, ſerving to impregnate the young ſeeds in the piſtil, and the impregnating matter is found to be duſt or powder in theſe apices; this is called, therefore, the farina fœcundans of plants; and however little this may have been ſuſpected to have to do with our ſubject, it is, indeed, the very thing of which the bees form their combs, or, in other words, the farina of plants is wax not yet reduced to form by the bees. Theſe little creatures ſeek no farther for the materials of their combs than to the apices of flowers; theſe, if of a more ſolid and firm texture, they are at the pains of opening with their teeth; or, if leſs tough or already opening, they rob of their farina, by rubbing their bodies among them, and ſo diſlodging the duſt which adheres to their bodies by means of the hairs they are covered with, and is thence collected into a maſs.

Wax is, indeed, excellently fitted for theſe purpoſes, being a kind of fatty reſin and turpentine, and qualified to anſwer all the uſes of a mixed body of that nature. It is, indeed, ſo evidently a vegetable production in its original, that it has not only been found almoſt pure in the farina of plants, but it is, ſometimes, exſudated from their very leaves. There is ſcarce any known plant, the ſtamina of which ſeem ſo much to abound with wax, as thoſe of roſemary; and theſe are not the only part that contains it. Whoſoever will handle the leaves of roſemary, will find a viſcid matter in conſiderable quantity; and this will, on continuing to handle them, be collected on the fingers in ſuch quantity, as to be rolled off in little lumps, which, when examined, are real wax, at leaſt, as pure as that in the farina of any plant in the world.

Spirit of wine, digeſted on freſh roſemary leaves, will alſo draw a ſort of tincture from this waxy matter on their ſurface, and this, when evaporated, will yield the ſame ſmell of wax as the tincture of the farina does, and will leave the ſame kind of ſoluble wax in the cake at leaſt.

However ſingular the total volatility of wax may appear to thoſe not uſed to chymical experiments, there is this to be obſerved in regard to it, that it ſhews the truth of the aſſertion, that it approaches the nature of turpentine; for turpentine, with a fire properly managed, will in the ſame manner all riſe over into the receiver: both theſe ſubſtances agree, alſo, with camphire, in this reſpect; though the diſparity between camphire and them, in regard to the degree of volatility, or the degree of fire neceſſary to raiſe them, is immenſe. They all have their ſeparate qualities alſo; after having been thus raiſed by fire, camphire becomes camphire again, and not a liquid oil; the very liquid oil of turpentine kept a conſiderable time loſes its fluidity, and becomes as thick as the turpentine it was made from; whereas, the butter of wax remains unaltered for ever ſo great a number of years, never becoming thicker than at firſt. It is alſo ſingular, that the repeated diſtillations of it, though they render it more thin and fluid, and greatly more penetrating, yet it becomes all the time more mild and gentle, leſs, not more, acrimonious, as might be expected.

From the common yellow wax, by the mere effect of ſun and air, or by what is called bleaching, is formed what we term white-wax; and ſome, very improperly, virgin-wax. As the greater the ſurface is in proportion

to the quantity, the ſooner and more perfectly this operation is performed. The uſual way is to melt the wax in hot water; when melted, they preſs it through a ſtrainer of tolerable fine linen, and pour it into round and very ſhallow moulds. When hardened by cooling, it is taken out and expoſed to the ſun and air, ſprinkling it now and then with water, and often turning it: by this means it ſoon becomes white. The beſt ſort is of a clear and almoſt tranſparent whiteneſs, dry, hard, brittle, and of an agreeable ſmell, like that of the yellow wax, but much weaker.

The common yellow wax is of very great uſe both in medicine and in many of the arts and manufactures. It is ſometimes given internally, as in dyſenteries, and other eroſions of the inteſtines; but its great uſe is in the making ointments and plaſters for external uſe, and the greater part of thoſe of the ſhops owe their conſiſtence to it. The white-wax is alſo an ingredient in ſome of the cerates and ointments of the ſhops; and is uſed in making candles, and in many of the nicer arts and manufactures, where wax is required.

Preparations of WAX. The butter and oil of wax are thus prepared: cut the wax in pieces and put them into a retort, which muſt be half filled with theſe pieces; and the reſt of the retort being filled with ſand, it muſt be placed in a ſand furnace. At firſt an acid ſpirit ariſes, and afterwards a thick oil, called the butter of wax, ſticks in the neck of the retort, unleſs it be heated by applying a live coal. This may be rectified into a thin oil, by diſtilling it ſeveral times, without addition, in a ſand-heat. The butter is an extremely ſoft and anodyne unguent; highly emollient and relaxing; agreeable to the nerves; and when rubbed on contracted limbs, proves of great benefit to them. It is an excellent liniment for the piles, and takes off the pain attending them in a very ſudden and ſurpriſing manner. It alſo keeps the ſkin ſoft, and is one of the beſt things known to keep it from cracking or chopping in the winter.

The oil of wax has alſo a very ſingular virtue in curing contracted tendons and reſtoring flexibility to the parts. It cures chapped nipples in women who give ſuck beyond any other application, and is as ſucceſsful againſt chapped lips, and the cracking of the ſkin of the hands, only rubbing them once in three or four days with it. It is alſo of great uſe in diſcuſſing cold tumours ariſing on the face, and thoſe on the fingers in winter.

Sealing-WAX is made in the following manner: take one pound of bees-wax; three ounces of fine turpentine; olive-oil, and roſin, finely powdered, of each one ounce: when they are well melted, and the droſs taken off, put in an ounce and a half of vermillion, or red-lead, finely ground, and ſtir them together till they are well incorporated: and when this mixture grows a little cool roll it into ſticks, or in any other form. If you would have it black, inſtead of vermillion, or red-lead, put in lamp-black. The ſoft, red, and green wax, uſed in large ſeals to ſome of our law-writings, are thus made: melt bees-wax over a gentle heat, with ſuch a proportion of Venice turpentine as, when cold, will give it the due conſiſtence: this is determined by repeated trials, firſt putting in but little turpentine, and afterwards more and more, till by dropping a piece upon a marble to cool, it is found of the true conſiſtence, They then colour it with red-lead, or vermillion, or with verditer, or whatever colours they pleaſe; the mixture in this ſtate receiving any.

Grafting-WAX, a compoſition ſerving to bind the graft to the cleft of the ſtock. For the manner of making which, ſee *Methods of* GRAFTING.

To imitate fruit in WAX. Take the fruit and bury it half way in clay; oil its edges, and that part of the fruit which is uncovered; then nimbly throw on it tempered alabaſter or plaſter of Paris, to a conſiderable thickneſs. When this is grown dry and hard, it makes the half mould; the ſecond half of which may be obtained in the ſame manner. The two parts of the mould being joined together, a little bees-wax melted and brought to a due heat, being poured through a hole made in a convenient part of the mould, and preſently ſhook therein, will repreſent the original fruit.

WAX-WORK, the repreſentation of the faces, &c. of perſons living or dead; made by applying plaſter of Paris in a kind of paſte, and thus forming a mould containing the exact repreſentation of the features. Into this mould melted wax is poured, and thus a kind of maſks are formed; which being painted and ſet with glaſs eyes, and the figures dreſſed in their proper habits, they bear ſuch a reſemblance that it is difficult to diſtinguiſh between the copy and the original.

WAXING, in chemiſtry, the preparation of any matter to render it fit and diſpoſed to liquify, or melt, which of itſelf it was not.

This is frequently done to enable things to penetrate into metals and other ſolid bodies.

WAY, a paſſage or road. See ROAD.

The Roman ways are divided into conſular, prætorian, military, and public; and of theſe we have four remarkable ones in England: the firſt, Watling-ſtreet, or Watheling-ſtreet, leading from Dover to London, Dunſtable, Towceſter, Atterſton, and the Severn, extending as far as Angleſea in Wales. The ſecond, called Hikenild, or Ikenild-ſtreet, ſtretches from Southampton over the river Iſis at Newbridge; thence by Camden and Lichfield; then paſſes the Derwent, near Derby, and ends at Tinmouth. The third, called Foſſe-way, becauſe in ſome places it was never perfected, but lies as a large ditch, leads from Cornwal through Devonſhire, by Tethbury, near Stow in the Wolds; and beſide Coventry to Leiceſter, Newark, and ſo to Lincoln. The fourth, called Erming, or Erminage-ſtreet, extends from St. David's, in Wales, to Southampton.

WAY *of a Ship*, is ſometimes the ſame as her rake, or run forward or backward: but this term is moſt commonly underſtood of her ſailing. Thus when ſhe goes apace, it is ſaid that ſhe hath a good way, or makes a freſh way. So when an account is kept how faſt ſhe ſails by the log, it is called keeping an account of her way; and becauſe moſt ſhips are apt to fall a little to leeward of their true courſe, they always in caſting up the log-board, allow ſomething for her leeward way.

WAY *of the Rounds*, in fortification, is a ſpace left for the paſſage of the rounds between the rampart and the wall of a fortified town. This is not now much in uſe; becauſe the parapet, not being above a foot thick, is ſoon overthrown by the enemy's cannon.

WAY-WISER, an inſtrument otherwiſe called perambulator. See PERAMBULATOR.

WAY-WODE, a title given to the governors of the chief places in the empire of Muſcovy, as alſo in Poland.

WEAR, or WEER, a great ſtank or dam in a river, fitted for the taking of fiſh, or for conveying the ſtream to a mill.

New wears are not to be made, or others altered, to the nuſance of the public, under a certain penalty.

WEASEL, in zoology, a ſpecies of muſtela, with the tip of the tail black.

This is a ſmaller animal than the pole-cat: the head is ſmall, of an ovated form, and ſharp at the ſnout: the ears are ſmall, ſhort, and patulous; the eyes of a fierce aſpect; the mouth well furniſhed with teeth; the upper jaw longer than the under: the body is about eight inches long, and ſlender: the tail is a third part the length of the body; the legs are ſhort and ſlender; the feet have five toes armed with ſharp claws; the whole body is covered with a fine and tolerably long fur: the back is of a darkiſh colour, and the belly is white.

WEATHER, the ſtate or diſpoſition of the atmoſphere, with regard to heat, cold, wind, rain, froſt, &c.

As it is in the atmoſphere that all plants and animals live and breathe, and as that appears to be the great principle of moſt animal and vegetable productions, alterations, &c. there does not ſeem any thing, in all philoſophy, of more immediate concernment to us, than the ſtate of the weather, and a knowledge of the great

 influ-

influence it has on our bodies, and the ſenſible alterations we undergo thereby. In effect, all living things are only aſſemblages or bundles of veſſels, whoſe juices are kept moving by the preſſure of the atmoſphere; and which, by that motion, maintain life: ſo that any alteration in the rarity or denſity, the heat, purity, &c. of that, muſt neceſſarily be attended with proportionable ones in theſe.

What vaſt, yet regular alterations, a little turn of weather makes in a tube filled with mercury, or ſpirit of wine, or in a piece of ſtring, &c. every body knows, in the common inſtance of barometers, thermometers, &c. and it is owing partly to our inattentions, and partly to our unequal, intemperate, courſe of living, that we do not feel as great and regular ones in the tubes, chords, and fibres of our own bodies. It is certain, a great part of the brute creation have a ſenſibility and ſagacity, this way, beyond mankind; and yet, without natural means or diſpoſition thereto, more than we; except that their veſſels, fibres, &c. being in other reſpects in one equal habitude, the ſame cauſe from without has always a like effect on them; that is, their veſſels are regular barometers, &c. affected only from one external principle, the diſpoſition of the atmoſphere; whereas ours are acted on by divers from within, as well as without; ſome of which check, impede, and prevent the action of others.

There is nothing more wanting than a juſt theory of the weather on mechanical principles. But in order to that, a complete hiſtory of the weather would be required. Were regiſters carefully kept in divers places of the earth, for a good ſeries of years, we ſhould be able to determine the directions, breadth, and bounds of the winds, and of the weather they bring with them; the correſpondence between the weather of divers places, and the dependence between one ſort and another of the ſame place. In time, we might learn to foretel heats, rains, froſts, dearths, plagues, and other epidemical diſeaſes, &c.

WEATHER-COCK, or WEATHER-VANE, a moveable vane in form of a cock, or other ſhape, placed on high, to be turned round according to the direction of the wind, and point out what quarter the wind blows from. See WIND.

WEATHER-GLASSES, are inſtruments contrived to indicate the ſtate or diſpoſition of the atmoſphere, and the various alterations in the weather; ſuch are barometers, thermometers, hygrometers, &c.

WEATHER-GAGE, in the ſea-language. See the article GAGE.

WEATHERING, among ſailors, ſignifies the doubling, or ſailing by a head-land, or other place.

WEAVING, the art of working a web of cloth, ſilk, or other ſtuff, in a loom with a ſhuttle.

WEAVING-LOOM, a machine for weaving cloth, ſilk, &c. by raiſing the threads of the warp in order to throw in the ſhoot, and ſtrike it cloſe. Of theſe there are various kinds, diſtinguiſhed by the different ſorts of cloths, ſtuffs, ſilks, &c. in which they are employed, and which are chiefly diſtinguiſhed by the number and variety of the threads they raiſe in order to work the warp, either plain or in figures, by making more or leſs of the woof or ſhoot appear through the warp.

In order to give a general idea of weaving, we ſhall here deſcribe the parts of the common weaver's loom. See plate CXL. *fig.* 1. in which 9, 9, are the loom-poſts; 10, the croſs-bars; 11, the batten, which ſerves to ſtrike in, and cloſe more or leſs the threads of the woof; 12, the cap of the batten, or a long bar, which the weaver takes hold of in one hand and then in the other; 13, the block, or under part of the ſame, containing the reed within the lower bar; 14, the croſs-piece, or burdon and pin, which helps to make the batten moveable; 15, the gallows, a piece of wood ſuſpending the pully, on which the cord moves that is tied to the two lams; 16, the breaſt-bar, a flat ſquare piece of wood, with an opening in it to let the ſtuff through, which is rolled on the knee-roll; 17, the cane-roll, which the warp is turned on at the other end of the loom; 18, the reed; 19, pullies upon which the cords roll that are faſtened to the lams; 20, the tumbler, which is a cord that paſſes from one lam to the other over the pulley 21, and cauſes the working of the lams by its aſcending and deſcending; 22, the muffle, in which the pully acts; 23, a ſkain, or leiſh, cut into proper lengths, to mend the leiſhes of the harneſs that happen to break; 24. a bobbin of the warp, to mend the threads of the warp that occaſionally break; 25. lizard thread to mend thoſe of the lizier that happen to break; and which, eſpecially in cloth, are very different from the warp; 26. the box to hold the quills; 28. the foot-bar; 29. the trundles, or moveable bars, tied with two cords to the lower virgee of each lam. When the foot preſſes a treddle, the lam that is faſtened to it ſinks, and the other riſes by the help of the tumbler; 30. the foot-ſtep; 31. the temple; a double flat ruler, having ſmall teeth at the extremities; it may be lengthened or ſhortened by the help of a catch that is in one of the rulers, and introduced in a groove in the other ruler. The teeth in the extremities are faſtened in the lizier of the work, by which means it is kept of an equal breadth; and as the work advances the temple is moved forwards; 32. the ſhuttle ſeen in front and profile; 33. the knee roll, on which the work is rolled as it is wove; 34. the tantow; an iron leaver to turn the knee-roll; 35. the reed ſeen ſeparate.

WEB, a tort of tiſſue, or texture formed of threads interwoven with each other; ſome whereof are extended in length, and called the warp; and others drawn acroſs, and called the woof. See the articles CLOTH, WARP, &c.

Spider's WEB, or *Cob*-WEB, is a very delicate and wonderful plexus, which that inſect ſpins out of its own bowels, ſerving it as a ſort of toil, or net to catch flies, &c. withal. For the manner wherein the ſpider ſpins his web, the admirable mechaniſm of the parts ſubſervient thereto, and the uſes thereof, ſee the articles SPIDER, and *Spider's* SILK.

WEDGE, *Cuneus*, the laſt of the five mechanical powers. It is a triangular priſm, whoſe baſes are equilateral acute-angled priſms.

The power of the wedge ACBH (plate CXL. *fig.* 2.) is evident from its conſiſting of two equal inclined planes AHC and BHC; as it is chiefly of uſe to ſeparate the adhering parts of wood, and ſince the power of coheſion in wood is every where variable and uncertain, it is evident there can be no regular calculation of the actual effect of the wedge; but if we ſuppoſe the power of coheſion in the wood ADEB to be uniform, or to make every-where an equal reſiſtance to the wedge ABC, dividing its parts AF and BG, then the power of the wedge would be to the reſiſtance of the wood as their velocities inverſely, that is, as the ſpaces moved through in the ſame time, that is, as the height of the wedge HC to half its width AH.

WEDNESDAY, the fourth day of the week, ſo called from a Saxon idol named Woden, ſuppoſed to be Mars, worſhipped on this day.

Aſh WEDNESDAY, the firſt day of Lent, ſo called from the cuſtom obſerved in the ancient chriſtian church of penitents expreſſing their humiliation at this time, by appearing in ſack-cloth and aſhes. The want of this diſcipline is at preſent ſupplied, by reading publicly on Aſh-wedneſday the curſes denounced in Scripture againſt the ſeveral ſorts of ſins, the people repeating after each curſe, Amen.

WEED, a common name for all rank and wild herbs, that grow of themſelves, to the detriment of other uſeful herbs they grow among.

The farmer finds it impoſſible ever wholly to deſtroy the weeds in his lands; and the reaſon ſeems to be, that in many kinds the ſeeds will lie many years in the ground, and ſucceſſively grow, ſome one year and ſome another; ſo that the deſtroying the crop entirely, for one year, does not kill them for ſucceeding ones. The ſeed of red-

poppy

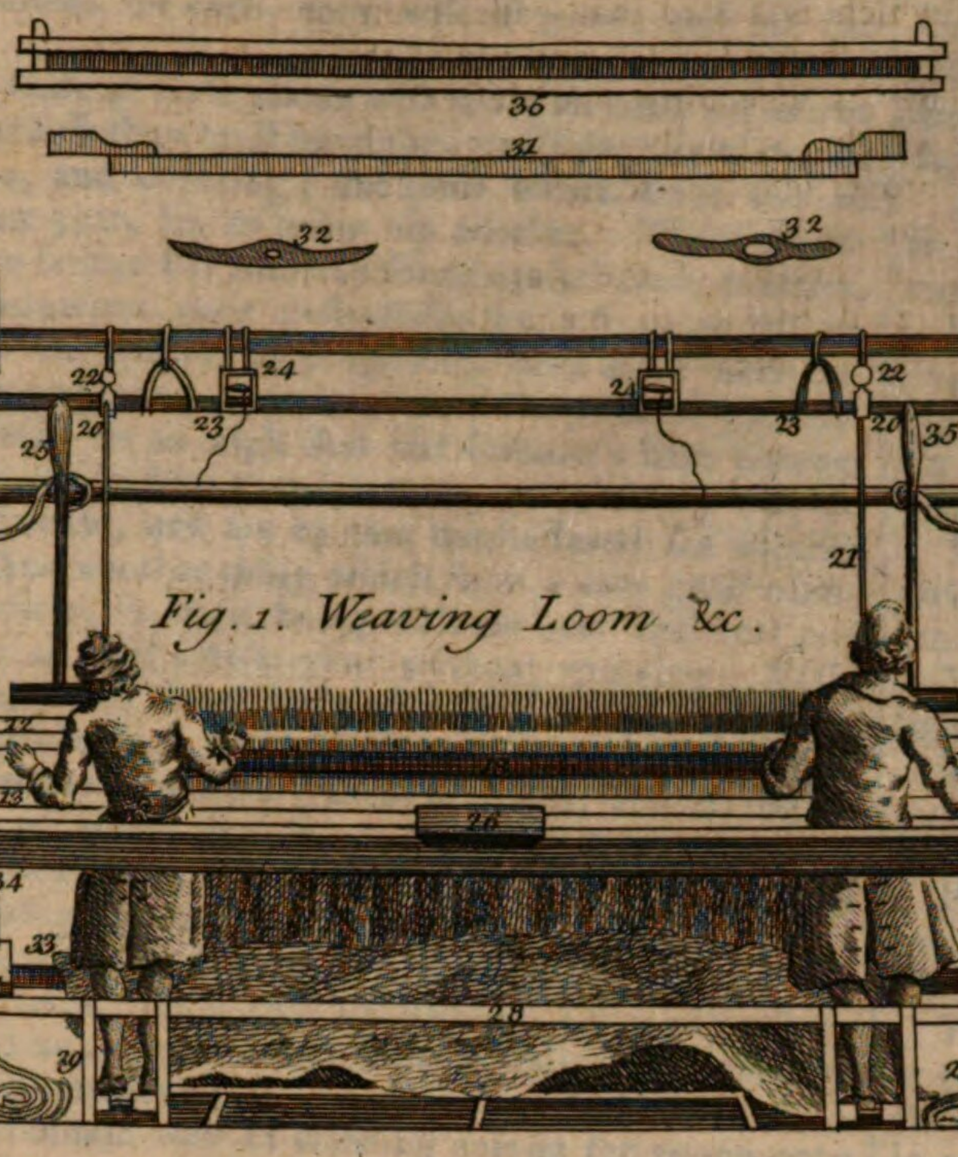


Fig. 1. Weaving Loom &c.

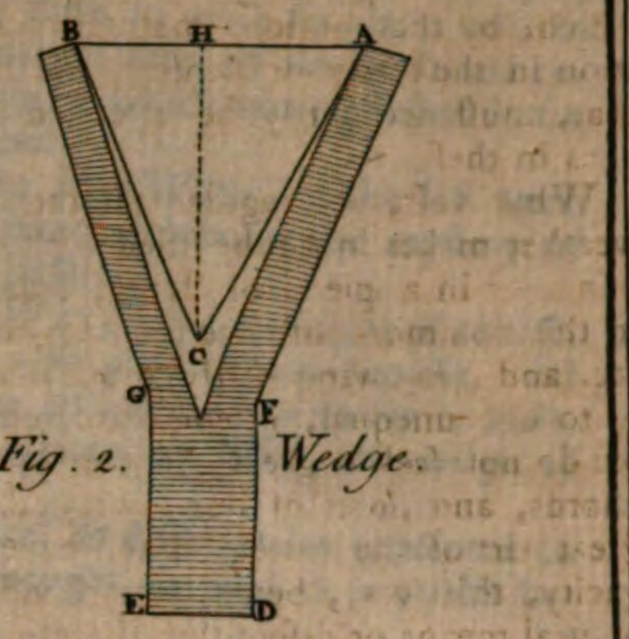


Fig. 2. Wedge.

Whispering Place.

Fig. 3.

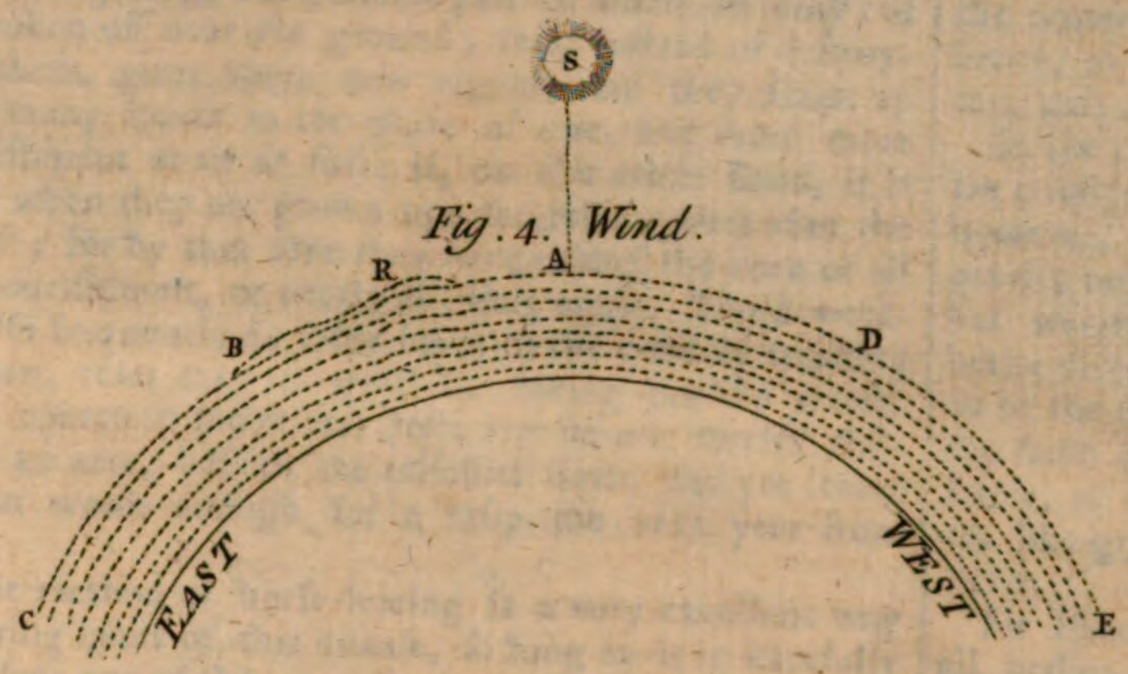


Fig. 4. Wind.

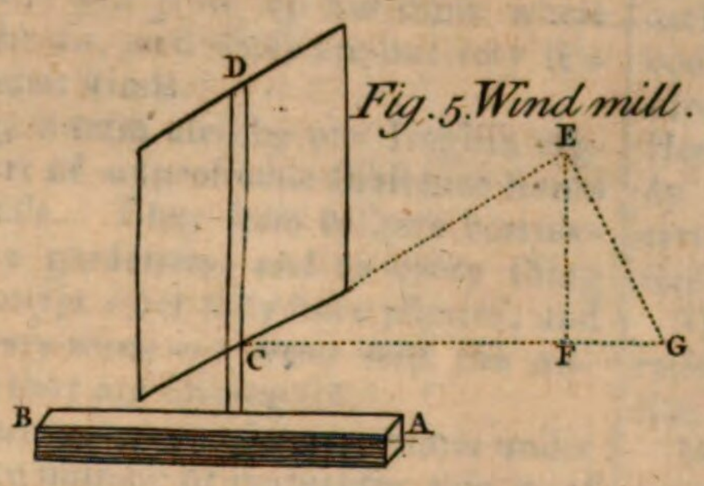
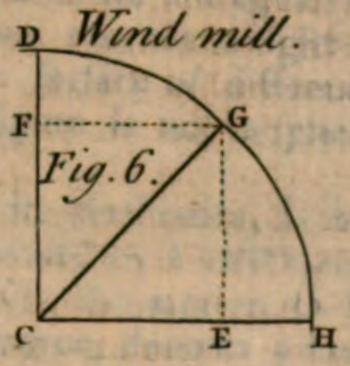


Fig. 5. Wind mill.



Wind mill.

Fig. 6.

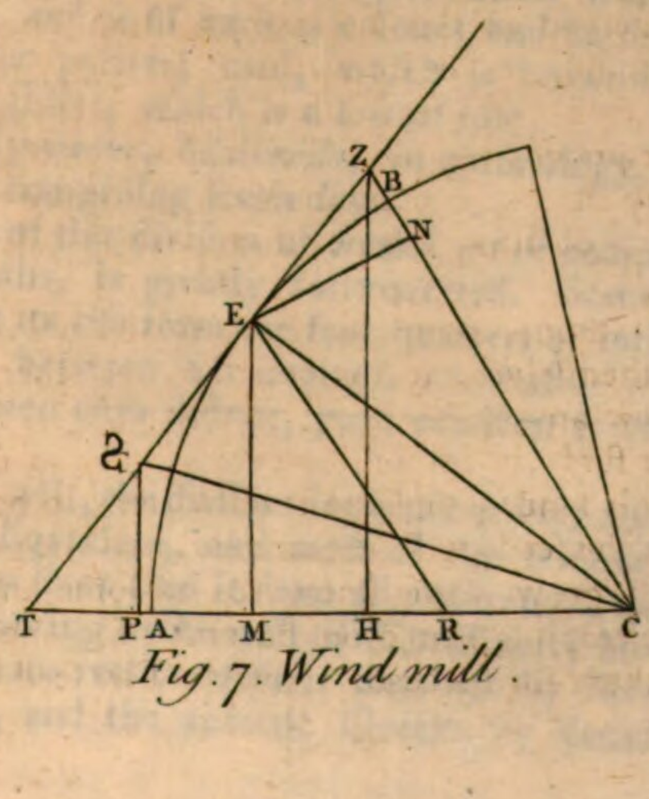


Fig. 7. Wind mill.

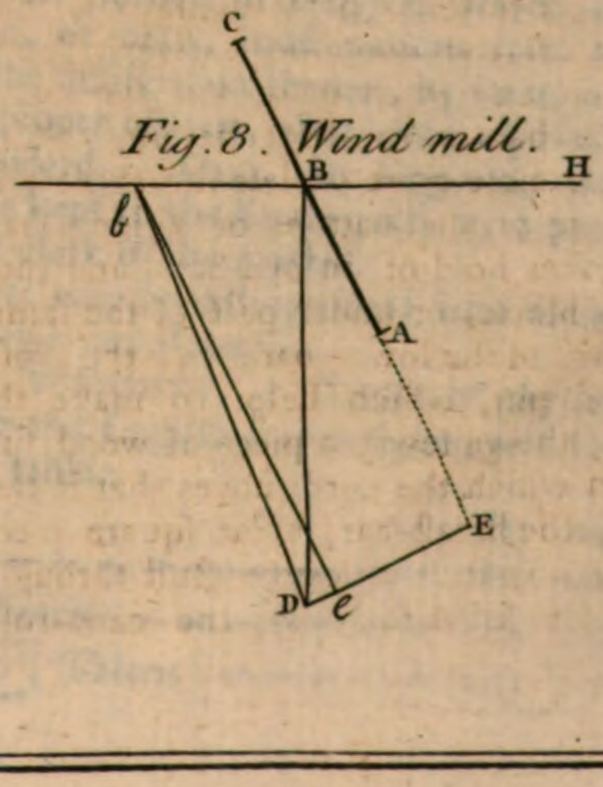


Fig. 8. Wind mill.

poppy will lie twenty years in the ground, in a land all that time occupied by ſaintfoin; and, if it be, after that, plowed for corn, they will all grow, and fill the field.

The ſeeds of theſe plants will never all come up in one year, becauſe they muſt have their exact degrees of depth, moiſture, and covering; the ſeeds which want any of theſe one year, lie to grow up another. The beſt defence the farmer has hitherto found againſt theſe enemies, is to endeavour their deſtruction by a ſummer fallow. This, if the weather be propitious, does make ſome havock among them, but it never deſtroys them entirely. If the ſeeds lie ſo high that the ſummer's heat parches them up, or ſo deep that it cannot reach them, they do not germinate, and are by that means ſaved for another year. And another thing which ſaves a very great number of them, is their being able to bear the heat and moiſture of the whole year without growing. Wild oats, and many other ſeeds of weeds, are of this kind. If you gather theſe when ripe, and ſow them in the moſt careful manner, watering them at times, and taking all the care of them that is neceſſary to the moſt tender plants, they will not grow till the ſpring come twelvemonths after they were ſowed, and ſometimes not till the ſpring after that; that is, two years and a half after the time of putting them into the ground. It is plain from this, that no art can deſtroy theſe by fallowing, or other means, in one year.

The common way of weeding among the young corn turns out to very little good; if this is done while the weeds are young, the greateſt part of them are only cut or broken off near the ground; this, inſtead of deſtroying them, gives them new vigour, and they ſhoot up with many heads in the place of one, and draw more nouriſhment than at firſt: if, on the other hand, it is done when they are grown up, the relief comes after the diſeaſe; for by that time they have robbed the corn of all the nouriſhment, or nearly all, they could. Hand-weeders alſo frequently do more harm in the corn by treading it down, than they do good by taking out the weeds. This operation ſometimes coſts the farmer twelve ſhillings an acre, beſides the miſchief done, and yet there remain weeds enough for a crop the next year from ſeeds.

The method of horſe-hoeing is a very excellent way of curing lands of this diſeaſe, ſo long as it is carefully practiſed; one of the greateſt advantages it will bring the farmer is, that no weeds will grow up but thoſe whoſe ſeeds are brought in the air, and theſe are but very few in compariſon of the other kinds.

WEEDS, in mining, a term uſed by our Engliſh diggers to expreſs any ſort of unprofitable ſubſtance found among the ores of metals. They ſeem to have borrowed the phraſe from the gardeners; and as every thing with them is a weed, except what they have planted, and expect to gather; ſo every thing is a weed with the miners, except the thing they are ſinking for.

The principal ſubſtances known in our mines under the names of weeds, are mundic or marcaſite; this is of three ſorts, white, yellow, and green; daze, a kind of glittering talcy ſtone, of the telaugium kind, which endures the fire, and is of various colours and hardneſſes; iron-moulds or pyritæ; caul, which is browniſh and ſpungy; and gliſter, which is a ſort of talc.

WEEK, *Septimana*, *hebdomada*, in chronology, a diviſion of time compriſing ſeven days.

The origin of this diviſion of weeks, or of computing time by ſevenths, is greatly controverted. Some will have it to take its riſe from the four quarters or intervals of the moon, between her changes or phaſes, which, being about ſeven days diſtant, gave occaſion to the diviſion.

Be this as it will, the diviſion is certainly very ancient. The Syrians, Egyptians, and moſt of the oriental nations, appear to have uſed it from all antiquity: though it did not get footing in the weſt till Chriſtianity brought it in: the Romans reckoned their days not by ſevenths but by ninths, and the ancient Greeks by decads or tenths.

Indeed, the Jews divided their time by weeks, but it was upon a different principle from the eaſtern nations, God himſelf appointing them to work ſix days, and to reſt the Sabbath, in order to keep up the ſenſe and remembrance of the creation; which being effected in ſix days, he reſted the ſeventh.

Paſſion WEEK, or the *Holy* WEEK, is the laſt week in Lent, wherein the church celebrates the myſtery of our Saviour's death and paſſion.

WEIGH, WAY, or WEY, *waga*, a weight of cheeſe, wool, &c. containing 256 pounds avoirdupoiſe. Of corn, the weigh contains 40 buſhels; of barley or malt, ſix quarters. In ſome places, as Eſſex, the weigh of cheeſe is 300 pounds.

WEIGHER, an officer in divers cities appointed to weigh the commodities bought or ſold in a public balance.

WEIGHING, the act of examining a body in the balance to find its weight.

WEIGHING-CHAIR, a machine contrived by Sanctorius, to determine the quantity of food taken at a meal, and to warn the feeder when he had his quantum.

WEIGHING-ANCHOR, is the drawing it out of the ground it had been caſt into, in order to ſet ſail, or quit a port, road, or the like.

WEIGHT, GRAVITY, *Pondus*, in phyſics, a quality in natural bodies whereby they tend downwards, towards the center of the earth. Or, weight may be defined, in a leſs limited manner, to be a power inherent in all bodies whereby they tend to ſome common point, called the center of gravity; and that with a greater or leſs velocity, as they are more or leſs denſe, or as the medium they paſs through is more or leſs rare.

In the common uſe of language, weight and gravity are conſidered as one and the ſame thing. Some authors, however, make a difference between them; and hold gravity only to expreſs a niſus or endeavour to deſcend, but weight an actual deſcent. But there is room for a better diſtinction. In effect, one may conceive gravity to be the quality as inherent in the body; and weight the ſame quality, exerting itſelf either againſt an obſtacle, or otherwiſe. Hence, weight may be diſtinguiſhed, like gravity, into abſolute and ſpecific. See GRAVITY.

Sir Iſaac Newton demonſtrates, that the weights of all bodies, at equal diſtances from the center of the earth, are proportionable to the quantities of matter each contains. Whence it follows, that the weights of bodies have not any dependence on their forms, or textures; and that all ſpaces are not equally full of matter. Hence, alſo, it follows, that the weight of the ſame body is different on the ſurface of different parts of the earth; by reaſon its figure is not a ſphere, but a ſpheroid.

WEIGHT, *Pondus*, in mechanics, is any thing to be raiſed, ſuſtained, or moved by a machine, or any thing that in any manner reſiſts the motion to be produced.

WEIGHT, in commerce, denotes a body of a known weight, appointed to be put in the ballance againſt other bodies, whoſe weight is required.

The ſecurity of commerce depending, in good meaſure, on the juſtneſs of weights, which are uſually of lead, iron, or braſs, moſt nations have taken care to prevent the falſification thereof, by ſtamping or marking them by proper officers, after being adjuſted by ſome original ſtandard. Thus, in England, the ſtandard of weights is kept in the Exchequer, by a particular officer called the clerk of the market.

Weights may be diſtinguiſhed into ancient and modern, foreign and domeſtic.

Ancient WEIGHTS. 1. Thoſe of the ancient Jews, reduced to the Engliſh troy weights, will ſtand as in the following table:

			lb.	oz.	dwt.	gr.
Shekel			00	00	09	02 4/7
60	Manch		02	03	06	10 2/7
3000	50	Talent	113	10	01	10 2/7

2. Grecian

2. Grecian and Roman weights, reduced to Engliſh troy weight, will ſtand as in the following table:

											oz.	dwt.	gr.
Lentes											00	00	$\frac{35}{112}$
4	Siliquæ										00	00	$03\frac{1}{28}$
12	3	Obolus									00	00	$09\frac{3}{28}$
24	6	2	Scriptulum								00	00	$18\frac{3}{14}$
72	18	6	3	Drachma							00	00	$06\frac{9}{14}$
96	24	8	4	$1\frac{1}{3}$	Sextula						00	03	$00\frac{6}{7}$
144	36	12	6	2	$1\frac{1}{2}$	Sicilicus					00	04	$13\frac{2}{7}$
192	48	16	8	$2\frac{2}{3}$	2	$1\frac{1}{3}$	Duella				00	06	$01\frac{5}{7}$
576	144	48	24	8	6	4	3	Uncia			00	18	$05\frac{1}{7}$
6912	1728	576	288	96	72	48	36	12	Libra		10	18	$13\frac{5}{7}$

The Roman ounce is the Engliſh avoirdupois ounce, which they divided into ſeven denarii, as well as eight drachms; and ſince they reckoned their denarius equal to the Attic drachm, this will make the Attic weights one eighth heavier than the correſponding Roman weights.

Modern European WEIGHTS. 1. Engliſh weights. By the twenty-ſeventh chapter of Magna Charta, the weights all over England are to be the ſame; but for different commodities, there are two different ſorts, viz. troy weight and avoirdupoiſe weight. The origin from which they are both raiſed, is a grain of wheat gathered in the middle of the ear.

In troy weight, twenty-four of theſe grains make a penny-weight ſterling; twenty penny-weights make one ounce; and twelve ounces one pound.

By this weight we weigh gold, ſilver, jewels, grains, and liquors. The apothecaries alſo uſe the troy pound, ounce, and grain; but they differ from the reſt in the intermediate diviſions. They divide the ounce into eight drachms; the drachm into three ſcruples, and the ſcruple into twenty grains.

In avoirdupoiſe weight, the pound contains ſixteen ounces, but the ounce is leſs by near one-twelfth than the troy ounce; this latter containing 490 grains, and the former only 448. The ounce contains 16 drachms. 80 ounces avoirdupois are only equal to 73 ounces troy; and 17 pounds troy equal to 14 pounds avoirdupoiſe. See AVOIRDUPOISE.

By avoirdupoiſe weight are weighed mercury, and grocery wares, baſe metals, wool, tallow, hemp, drugs, bread, &c.

Table of troy weight as uſed by the

Goldſmiths.

Grains		
24	Penny-weight	
480	20	Ounce
5760	240	12 Pound

Apothecaries.

Grains.			
20	Scruple		
60	3	Drachm	
480	24	8	Ounce
5760	288	96	12 Pound

Table of avoirdupoiſe weight.

Scruples				
3	Drachm			
24	8	Ounce		
384	128	16	Pound	
43008	14336	1792	112	Quintal, or Hundred
860100	286720	35840	2240	20 Ton

The moneyers, jewellers, &c. have a particular claſs of weights, for gold and precious ſtones, viz. carat and grain; and for ſilver, the penny-weight and grain.

The moneyers have alſo a peculiar ſubdiviſion of the grain troy: thus,

The { Grain, Mite, Droit, Perit } into { 20 Mites, 24 Droits, 20 Perits, 24 Blanks.

The dealers in wool have likewiſe a particular ſet of weights, viz. the ſack, weigh, tod, ſtone, and clove.

2. French weights: the common or Paris pound is 16 ounces; which they divide two ways: the firſt diviſion is into two marcs; the marc into 8 ounces; the ounce into 8 gros; the gros into 3 penny-weights; the penny-weight into 24 grains; the grain equal to a grain of wheat. The ſecond diviſion of the pound is into 2 half pounds; the half pound into 2 quarters; the quarter into 2 half quarters; the half quarter into 2 ounces; and the ounce into 2 half ounces.

The weights of the firſt diviſion are uſed to weigh gold, ſilver, and the richer commodities; and the weights of the ſecond diviſion, for commodities of leſs value.

Grains

24	Penny-weight				
72	3	Gros			
576	24	8	Ounce		
4608	192	64	8	Marc	
9216	384	128	16	2	Pound.

Half ounce

2	Ounce					
4	2	Half-quarter pound				
8	4	2	Quarter pound			
16	8	4	2	Half pound		
32	16	8	4	2	Pound	
3200	1600	800	400	200	100	Quintal.

But the pound is not the ſame throughout France. At Lyons, the city pound is only 14 ounces; ſo that 100 Lyons pounds make only 88 Paris pounds. But beſide the city pound, they have another at Lyons for ſilk, containing 16 ounces. At Thouloufe, and throughout the Upper-Languedoc, the pound is 13 ounces and a half of Paris weight. At Rouen, beſide the common Paris pound and marc, they have the weight of the vicomte; which is 16 ounces, a half, and five-ſixths of the Paris weight.

The weights, enumerated under the two articles of Engliſh and French weights, are the ſame that are uſed throughout the greateſt part of Europe; only under ſomewhat different names, diviſions, and proportions.

Particular nations have alſo certain weights peculiar to themſelves: Thus Spain has its arrobas, containing 25 Spaniſh pounds, or one-fourth of the common quintal: its quintal macho, containing 150 pounds, or one-half common quintal, or 6 arrobas: its adarme, containing one-ſixteenth of its ounce. And for gold, it has its caſtillan, or one-hundredth of a pound; its tomin, con-

containing 12 grains, or one-eighth of a caſtillan. The ſame are in uſe in the Spaniſh Weſt-Indies.

Portugal has its arroba, containing 32 Liſbon arratels, or pounds. Savary alſo mentions its faratelle, containing 2 Liſbon pounds; and its rottoli, containing about 12 pounds. And for gold, its chego, containing four carats. The ſame are uſed in the Portugueſe Eaſt-Indies.

Italy, and particularly Venice, have their migliaro, containing four mirres; the mirre, containing 30 Venice pounds; the faggio, containing a ſixth part of an ounce.

Genoa has five kinds of weights, viz. large weights, whereby all merchandizes are weighed at the cuſtom-houſe: caſh-weights for piaſtres, and other ſpecies: the cantara, or quintal, for the coarſeſt commodities; the large balance for raw ſilks; and the ſmall balance for the finer commodities. Sicily has its rotollo, 32 and a half pounds of Meſſina.

Germany, Flanders, Holland, the Hanſe-Towns, Sweden, Denmark, Poland, &c. have their ſchippondt, which at Antwerp and Hamburgh, is 300 pounds; at Lubeck, 320; and at Coningſberg, 400 pounds. In Sweden, the ſchippondt for copper is 320 pounds; and the ſchippondt for proviſions 400 pounds. At Riga and Revel, the ſchippondt is 400 pounds; at Dantzic, 340 pounds; in Norway, 300 pounds; at Amſterdam, 300; containing 20 lyſpondts, each weighing 15 pounds.

In Muſcovy, they weigh their large commodities by the bercheroct, or berkewits, containing 400 of their pounds. They have alſo the poet, or poede, containing 40 pounds, or one-tenth of the bercheroct.

In order to ſhew the proportion of the ſeveral weights uſed throughout Europe, we ſhall add a reduction of them to one ſtandard, viz. the London and Amſterdam pound.

1. Proportion of the weights of the principal places of Europe.

The 100 ℔. of England, Scotland, and Ireland are equal to

℔.	oz.	
91	8	of Amſterdam, Paris, &c.
96	8	of Antwerp or Brabant.
88	0	of Rouen, the viſcounty weight.
106	0	of Lyons, the city weight.
90	9	of Rochelle.
107	11	of Toulouſe and Upper Languedoc.
113	0	of Marſeilles or Provence.
81	7	of Geneva.
93	5	of Hamburgh.
89	7	of Francfort, &c.
96	1	of Leipſic, &c.
137	4	of Genoa.
132	11	of Leghorn.
153	11	of Milan.
152	0	of Venice.
154	10	of Naples.
97	0	of Seville, Cadiz, &c.
104	13	of Portugal.
96	5	of Liege.
112	$\frac{2}{3}$	of Ruſſia.
107	$\frac{1}{24}$	of Sweden.
89	$\frac{1}{2}$	of Denmark.

2. Proportion of the weights of the chief cities in Europe to thoſe of Amſterdam.

An 100 pounds of Amſterdam are equal to

℔.	
108	of Alicant.
105	of Antwerp.
120	of Archangel, or 3 poedes.
105	of Arſchot.
120	of Avignon.
98	of Baſil in Switzerland.
100	of Bayonne in France.
166	of Bergamo.
97	of Bergen-op-zoom.
95$\frac{1}{4}$	of Bergen in Norway.
111	of Bern.
100	of Beſançon.
100	of Bilboa.
105	of Bois le duc.
151	of Bologna.
100	of Bourdeaux.
104	of Bourgen Breſſe.
103	of Bremen.
125	of Breſlaw.
105	of Bruges.
105	of Bruſſels.
105	of Cadiz.
105	of Cologne.
125	of Coningſberg.
107$\frac{1}{2}$	of Copenhagen.
87	rottos of Conſtantinople.
113$\frac{1}{2}$	of Dantzic.
100	of Dort.
97	of Dublin.
97	of Edinburgh.
143	of Florence.
98	of Francfort on the Maine.
105	of Ghent.
89	of Geneva.
163	of Genoa, caſh weight.
102	of Hamburgh.
106	of Leyden.
105	of Leipſic.
105$\frac{1}{2}$	of Liege.
114	of Liſle.
143	of Leghorn.
106$\frac{1}{2}$	of Liſbon.
109	of London, avoirdupoiſe weight.
105	of Louvaine.
105	of Lubec.
141$\frac{1}{2}$	of Lucca, light weight.
116	of Lyons, city weight.
114	of Madrid.
105	of Marlines.
123$\frac{1}{2}$	of Marſeilles.
154	of Meſſina, light weight.
168	of Milan.
120	of Montpelier.
125	bercheroćts of Muſcovy.
100	of Nantes.
106	of Nancy.
169	of Naples.
98	of Nuremberg.
100	of Paris.
112$\frac{1}{2}$	of Revel.
109	of Riga.
100	of Rochelle.
146	of Rome.
100	of Rotterdam.
96	of Rouen, viſcounty weight.
100	of St. Malo.
100	of St. Sebaſtian.
158$\frac{1}{2}$	of Saragoſa.
106	of Seville.
114	of Smyrna.
110	of Stetin.
81	of Thoulouſe and Upper Languedoc.
151	of Turin.
158$\frac{1}{2}$	of Valencia.
182	of Venice, ſmall weight.

WEIGHTS *uſed in the ſeveral parts of Aſia, the Eaſt-Indies, China, Perſia*, &c. In Turky, at Smyrna, &c. they uſe the batman, or battemant, containing ſix occos; the occo weighing three pounds four-fifths Engliſh. They have another batman much leſs, conſiſting as the former, of ſix occos; but the occo only containing fifteen ounces Engliſh: 44 occos of the firſt kind make the Turkiſh quintal. At Cairo, Alexandretta, Aleppo, and Alexandria, they uſe the rotto, rotton, or rottoli. The rottoli at Cairo, and other parts of Egypt, is 144 drachms; being ſomewhat over an Engliſh pound. At Aleppo there are three ſorts of rottos; the firſt, 720 drachms, making about 7 Engliſh pounds, and ſerving to weigh cotton, galls, and other large commodities; the ſecond is 624 drachms, uſed for all ſilks but white ones, which are weighed by the third rotto of 700 drachms. At Seyda the rotto is 600 drachms.

The other ports of the Levant, not named here, uſe ſome of theſe weights; particularly the occo, or ocqua, the rottoli, and rotto.

The Chineſe weights are, the piece, for large commodities; it is divided into 100 catis, or cattis: tho' ſome ſay, into 125; the cati into 16 taels, or tales; each tael equal to 1 $\frac{1}{3}$ of an Engliſh ounce, or the weight of 1 rial and $\frac{1}{12}$, and containing 12 mas, or maſſes, and each mas 10 condrins. So that the Chineſe piece amounts to 137 Engliſh pounds avoirdupois, and the cadi to 1 pound 8 ounces. The picol for ſilk, containing 66 catis and $\frac{3}{4}$; the bahar, bakaire, or barr, containing 300 catis.

Tonquin has alſo the ſame weights, meaſures, &c. as China. Japan has only one weight, viz. the cati; which, however, is different from that of China, as containing twenty taels.

At Surat, Agra, and throughout the ſtates of the great mogul, they uſe the man, or maund, whereof they have two kinds; the king's man, or king's weight; and the man ſimply; the firſt uſed for the weighing of common proviſions, containing forty ſeers, or ſerres; and each ſeer a juſt Paris pound. The common man uſed in the weighing of merchandize, conſiſts likewiſe of 40 ſeers, but each ſeer is only eſtimated at 12 Paris ounces, or $\frac{3}{4}$ of the other ſeer.

The man may be looked upon as the common weight of the Eaſt-Indies, though under ſome difference of name, or rather of pronunciation; it being called mao at Gambaya, and in other places mein, and maun. The ſeer is properly the Indian pound, and of univerſal uſe: the like may be ſaid of the bahar, tael, and catti, above-mentioned.

The weights of Siam, are, the piece, containing 2 ſhans, or cattis; but the Siameſe catti is only half the Japoneſe; the latter containing 20 taels, and the former only 10: though ſome make the Chineſe catti only 16 taels, and the Siameſe 8. The tael contains four baats or ticals; each about a Paris ounce; the baat 4 ſelings, or mayonnes; the mayon 2 fouangs; the fouang 4 payes; the paye 2 clams; the ſompaye $\frac{1}{2}$ fouang.

It is to be obſerved, that thoſe are the names of their coins as well as weights; ſilver and gold being commodities there ſold, as other things, by their weights.

In the Iſle of Java, and particularly at Bantam, they uſe the gantam, which amounts to near three Dutch pounds.

In Golconda, at Viſapour, and Goa, they have the furatelle, containing 1 pound 14 ounces Engliſh; the mangalis, or mangelin, for weighing diamonds and precious ſtones; weighing at Goa 5 grains, at Golconda, &c. 5 $\frac{1}{2}$ grains. They have alſo the rotola, containing 14 $\frac{1}{2}$ ounces Engliſh; the metricol, containing the ſixth part of an ounce; the wall, for piaſtres and ducats, containing the ſeventy-third part of a rial.

In Perſia, they uſe two kinds of batmans, or mans; the one called cahi, or cheray, which is the king's weight; and the other, batman of Tauris. The firſt 13 pounds 10 ounces Engliſh; the ſecond, 6$\frac{1}{2}$ pounds. Its diviſions are, the ratel, or a 16th; the derhem, or drachm, which is the 50th; the meſchal, which is half the derhem; the dung, which is the 6th part of the meſchal, being equal to ſix carat grains; and, laſtly, the grain, which is the fourth part of the dung. They have alſo the vakie, which exceeds our ounce a little; the ſah-cheray, equal to the 1170th part of the derhem; and the toman, uſed to weigh our large payments of money, without telling; its weight is that of fifty abaſſis.

African and American weights. We have little to ſay as to the weights of America; the ſeveral European colonies there making uſe of the weights of the ſtates or kingdoms they belong to. For, as to the aroue of Peru, which weighs 27 pounds, it is evidently no other than the Spaniſh arroba, with a little difference in the name.

As to the weights of Africa, there are few places that have any, except Egypt, and the countries bordering on the Mediterranean; whoſe weights have been already enumerated among thoſe of the ports of the Levant. The Iſland of Madagaſcar, indeed, has weights, but none that exceed the drachm, nor are they uſed for any thing but for gold and ſilver.

WEIGHT *of the Air*. See AIR.

WELD, or WOLD, in botany, the name of a plant much uſed by the dyers to give a yellow colour to woollens, ſilks, cotton, and thread.

Its root, which is compoſed of a few ligneous fibres, does not pierce deep: from this root it puts forth leaves about four inches long, and half an inch broad, of a lively green, ſoft to the touch, and ſpread circularly near the ground, with ſome gentle wavings at their edges, but obtuſe at their points. Its ſtem, which riſes from amidſt theſe leaves to the height of three feet, or even more if the ſoil and culture be very good, often branches out, and is garniſhed with leaves like thoſe below, though ſmaller in proportion as they approach the flowers, which grow in long looſe ſpikes at the end of the branches or ſtem. Theſe flowers, which appear at the latter end of June, are each of them compoſed of three ſmall irregular petals of a greeniſh yellow, to which ſucceeds a globular berry of the ſame colour, terminated by three points, and in which are incloſed ſmall brown ſpherical ſeeds. Theſe ſeeds ripen in September. The plant becomes entirely yellow when it is dry, and the whole of it, but eſpecially the berry, is uſed in dying. The ſlendereſt weld, and particularly if it inclines to a ruſſet colour, is accounted the beſt: that which is larger, and of a dull green, is much leſs eſteemed.

This plant grows naturally along the ſides of highways, upon dry banks, and on old walls, in many parts of England, France, Spain, and other countries where the winters are not very ſevere; but the cultivated ſort is far preferable to the wild, both for the quantity and the goodneſs of the colour which it yields. It will thrive tolerably on almoſt any ſoil, provided it be dry and warm: but the richer the land is upon which it is ſown, the greater will be the produce; and in proportion to the care with which it is cultivated, the more vigorous and fit for dying will it be.

The ground for this, as for every other plant, ſhould be in fine tilth at the time of ſowing it; though here, unleſs it be very poor indeed, it will not require dung. The ſeed ſhould be that of the preceding year; for if it be older, great part of it will not grow. Both Mr. Worlidge and M. Du Hamel are of opinion that weld ſeed ſhould, on account of its ſmallneſs, for it is but little bigger than that of purſlane, be mixed with aſhes, buckwheat, oats, or ſome other ſimilar ingredient, in order the better to avoid ſowing it too thick: for the plants of weld thrive beſt when they are about ſix inches aſunder. For this reaſon, as was before obſerved in regard to all plants which require being hoed, it is beſt to ſow weld in rows. Some ſow it on barley, or oats after they have been ſown and harrowed, this requiring only a buſh to be drawn over it; for it ſhould not be covered deep. A gallon of weld-ſeed thus uſed in the broad caſt way will be ſufficient to ſow an acre of land. It will not grow much during the firſt ſummer, when it is thus ſown; but it will thrive apace after the corn is taken off.

The beginning or middle of Auguſt is a proper ſeaſon for ſowing weld in this country. The only care that it requires whilſt growing, is to keep it clear of weeds which might choak it, or at leaſt weaken its growth.

The French, in general, ſow their weld in March, and pull it up in July or Auguſt of the enſuing year, when part of its ſeeds are ripe, and the plant is ſtill of a greeniſh yellow: they then dry it and threſh it upon cloths, to get the ripeſt of the ſeed, and after this they tie the ſtalks up in bundles, and ſell them to the dyers. But Mr. Miller rightly judges, that the beſt time to pull the weld for uſe is when it begins to flower, that is to ſay, about the latter end of June, becauſe, like all other vegetables, it is then in its greateſt vigour, and conſequently beſt fitted to yield the greateſt quantity of dye. For a produce of new ſeeds, it is much better to ſow a ſmall piece of land on purpoſe, or to ſet apart for this end a ſuitable portion of the field of which the plants are intended for uſe, rather than let the whole ſtand too long, that is to ſay, till part of the ſeeds are ripe; becauſe, by letting the plants

plants ſtand till then, their quality is injured far beyond the value of the ſeeds that are got from them (the berries being, as was obſerved before, the part which yields the fineſt dye); and beſides the ſeeds thus obtained will of courſe be a mixture of ripe and half-ripe ones, on the growing of which there cannot be a due reliance. The common way of drying theſe plants is to ſet them upright in ſmall handfuls in the field, and when they are dry, to tie them up in bundles. They muſt alſo be houſed dry; and care muſt be taken to ſtack them ſo looſely that there may be room for the air to paſs between them, to prevent their fermenting.

The plants which are intended for ſeed ſhould be pulled as ſoon as their ſeeds are ripe, and then dried and beaten out for uſe: for if this is deferred, or if they are let ſtand too long, the ſeeds will ſcatter.

The method of cultivating this plant at Oiſſel, in Normandy, where great quantities of it are raiſed for exportation to Holland, independent of the conſumption in France, is thus related by M. Dambourney, in the Memoirs of the Royal Society of Agriculture at Rouen.

"In the month of July, juſt after the kidney beans then in bloom have been hoed for the ſecond time, and earthed up, eſpecially if there be an appearance of approaching rain, weld-ſeed is ſown among them, very thin, as equally as poſſible. Careful huſbandmen bury this ſeed by dragging over it a ſmall buſh of thorns. Whilſt the weld riſes, the beans ripen and are gathered; after which the ground remains, of courſe, planted with weld only. This is hoed about Michaelmas, then left in that condition during the winter, and in the enſuing month of March, when the danger of froſts is judged to be over, it is hoed again, to extirpate ſuch weeds as may have come up in the mean time. Towards the end of June in this ſecond year, when the weld has done bloſſoming, when its berries form, and when the plant begins to turn yellow, advantage is taken of the firſt fair day after a rainy one, to pull it up. Two men will then pull up as much of it in one day, as four men can when the ground is dry and hard. It is carried off in large bundles: but theſe are untied before the weld is laid up for keeping, and the plants are ſpread out and ſet upright againſt walls or hedges well expoſed to the ſun, the heat of which completes their drying in two days. They are then laid upon a cloth to prevent the loſs of the ſeed, which drops very eaſily out of the now open capſules; and finally, after being tied up again in bundles weighing about thirty-pounds a-piece, they are piled up looſely in a barn or other well covered place, where they complete their ripening, and generally ſhrink to leſs than half of their former weight.

"Weld raiſed on rich ground is apt to be greaſy and too full of ſtalks: that which grows in ſandy places is of a better quality, and has only one main ſtem: but, in return, the produce here is much leſs than in the former caſe.

"As ſoon as the weld has been pulled, ſheep are turned in upon the land, to eat up the graſs it may have produced: it is then plowed once; and after another plowing at the end of October, it is ſowed with wheat, or great rye, without uſing any other compoſt or dung. If the land is light and deſtined for ſpring-corn, turnips may be ſown upon the firſt plowing after the weld; for they will have time to grow big enough to be pulled before the plowing for oats or ſmall rye, which laſt crops it will be proper to help with a little ſhavings or raſpings of horn.

"If it be intended to raiſe weld after peas, the ground ſhould be plowed, and the ſeed ſown very thin: to do which the more effectually, this ſeed, like that of turnips, ſhould be taken up only in pinches between the middle finger and the thumb, and the fore-finger ſhould remain extended, the better to help its ſpreading when it is dropped. This ſeed ſhould be ſown in rows ſufficiently diſtant for the plants to have full room to grow; and the beſt way is to leave an alley after every third row. When ſown, it is harrowed in, and the only farther care that the weld requires is to keep the plants free from weeds, by hoeing the ground at Michaelmas and in March, as before directed.

"The weld which is ſown after peas does not injure the land it grows on; and therefore in this caſe, as after the kidney-beans before ſpoken of, wheat may be ſown in October, without any previous manure."

WELDING HEAT, in ſmithery, a degree of heat given to iron, &c. ſufficient only for bending, or doubling it up.

WELL, a hole under ground, uſually of a cylindrical figure, and walled with ſtone, brick, &c. and mortar: its uſe is to collect the water of the ſtrata around it.

The riſing of water in wells is thus accounted for. Suppoſe a well be ſunk at the foot of a hill to ſuch a depth as will bring the diggers to an eruption of a ſpring, whoſe water is brought by a duct from a cavity in the hill, or otherwiſe from a pond, a river, the ſea, &c. it is evident the water in the well will riſe from the bottom to an altitude, where the ſurface of the water is upon a level with that in the reſervoir, and thus conſtitutes a well. See plate CXXII. *fig.* 10. where E repreſents the mouth of the well.

If thoſe reſervoirs of water in the body of mountains be ſituated where mineral ores abound, or the ducts or feeding ſtreams run through mineral earth, it is eaſy to conceive the particles of metal will mix with, and be abſorbed by the water, which being ſaturated therewith, becomes a mineral ſpring or well. If ſalt, ſulphur, lime-ſtone, &c. abound in the ſtrata, through which the water paſſes, it will then be ſaline, ſulphureous, lime-water, &c. If ſulphur and iron ſhould both abound in the parts of the hill, whence the waters come, the waters will partake of the warmth or heat, which is occaſioned by the mixture of two ſuch ſubſtances in the earth, where they are found. Now, though every thing may not happen preciſely in the manner as here repreſented, yet that it is in ſome way analogous to it, we believe no perſon will doubt, who has been at the Peak in Derbyſhire, or at Wookey-Hole in Somerſetſhire, and ſeen the wonderful caverns, receptacles and ſtreams of water, which nature has there furniſhed in the bowels of the mountains.

WELL, in the military art, a depth which the miner ſinks under ground, with branches or galleries running out from it; either to prepare a mine, or to diſcover and diſappoint the enemy's mine.

WELL-HOLE, in building, is the hole left in a floor for the ſtairs to come up through. See STAIRS.

WEN, a tumour or excreſcence that ariſes on different parts of the body, and contains a cyſtus, or bag filled with ſome peculiar matter, of which phyſicians reckon three kinds, viz. when this matter is ſoft, reſembling pulp, the wen is called atheroma; if like honey, meliceris; and if like ſuet, ſteatoma. See the articles TUMOUR, ATHEROMA, &c.

WERE, in our old law-books, denotes a ſum paid for killing a perſon, when ſuch crimes were puniſhed with pecuniary mulct, and not death.

WERELADA, among our Saxon anceſtors, the denying an homicide on oath, in order to be quit of the fine called WERE.

WERGILD, or WEREGELD, in our ancient cuſtoms, the price of a man's head: a part of which was paid to the king, for the loſs of his ſubject, a part to the lord whoſe vaſſal he was, and a part to the neareſt relation of the perſon ſlain.

WEST, in coſmography, one of the cardinal points of the horizon, diametrically oppoſite to the eaſt; and ſtrictly defined, the interſection of the prime vertical with the horizon, on that ſide the ſun ſets in. See HORIZON.

In aſtronomy, weſt is chiefly uſed for the place in, or towards which, the ſun or ſtars ſink under the horizon. Thus we ſay, the ſun, Mars, &c. are in the weſt. The point the ſun ſets in, when in the equator, is particularly called, the equinoctial weſt, or point of true weſt. See EQUINOCTIAL.

In geography, weſt and weſtern, are applied to ſeveral countries, &c. ſituate towards the point of ſun-ſetting, with reſpect to certain others. Thus the Roman empire was anciently, and the German empire is at preſent, called

called the empire of the weſt, or the weſtern empire, in oppoſition to that of Conſtantinople, which is called the eaſtern empire.

The Roman church is called the weſtern church in oppoſition to the Greek church. The Italians, French, Spaniards, &c. are called weſtern nations, in reſpect to the Aſiatics; and part of America, the Weſt-Indies, in reſpect to the Eaſt-Indies.

WHALE, *Balæna*, in zoology, a genus of fiſhes, diſtinguiſhed by having certain laminæ, of a horny ſubſtance, in the upper jaw, which ſupply the place of teeth, and uſually no fin upon the back: to this it may be added, that the fiſtula, or aperture, for the diſcharge of water, is double, and ſituated either on the forehead, in the middle of the head, or in the roſtrum.

The balæna with the fiſtula in the middle of the head, and the back ridged towards the tail, is the fiſh determinately and properly called the whale, though the phyſeter, as well that with the upper jaw longeſt, and with a long ſpine on the back, as that with the back-fin very tall, and the ſummit of the teeth plane, is the former called the crooked tooth whale, and the latter the plane tooth whale; as is alſo that phyſeter which is a ſpecies of the balæna.

The balæna, or the whale properly ſo called, grows to a monſtrous ſize; the head is extremely large, and of an irregular figure, the lower jaw is much larger than the upper, and covers it at the ſides; the upper is narrow and oblong, the fiſtula is double, or has two diſtinct apertures, and is ſituated in the middle of the head, between the eyes; the eyes are very ſmall in proportion to the enormous bulk of the head, and are placed a great diſtance from one another; the whole head is ſomewhat depreſſed, and has ſeveral irregularities on its ſurface; the body is very thick, and ſomewhat rounded, but towards the extremity of the back, there is a ſubacute angle, extending itſelf longitudinally to the tail; the tail is ſomewhat forked, very large, and in its horizontal ſituation makes a very ſingular figure. This is an inhabitant of the moſt northern ſeas, the principal object of the Greenland fiſhery, and the firſt known ſpecies.

WHALE-*Fiſhery*. — Whales are chiefly caught in the North ſea: the largeſt ſort are found about Greenland, or Spitzbergen. At the firſt diſcovery of this country, whales not being uſed to be diſturbed, frequently came into the very bays, and were accordingly killed almoſt cloſe to the ſhore, ſo that the blubber being cut off was immediately boiled into oil on the ſpot. The ſhips in theſe times, took in nothing but the pure oil and the fins, and all the buſineſs was executed in the country, by which means a ſhip could bring home the product of many more whales than ſhe can according to the preſent method of conducting this trade. The fiſhery alſo was then ſo plentiful, that they were obliged ſometimes to ſend other ſhips to fetch off the oil they had made, the quantity being more than the fiſhing ſhips could bring away. But time and change of circumſtances have ſhifted the ſituation of this trade. The ſhips coming in ſuch numbers from Holland, Denmark, Hamburgh, and other northern countries, all intruders upon the Engliſh, who were the firſt diſcoverers of Greenland, the whales diſturbed, and gradually, as other fiſh often do, forſaking the place, were not to be killed ſo near the ſhore as before, but are now found, and have been ſo ever ſince, in the openings and ſpaces among the ice, where they have deep water, and where they go ſometimes a great many leagues from the ſhore.

The whale-fiſhery begins in May, and continues all June and July; but whether the ſhips have good or bad ſucceſs, they muſt come away and get clear of the ice by the end of Auguſt; ſo that in the month of September at fartheſt, they may be expected home; but a ſhip that meets with a fortunate and early fiſhery in May, may return in June or July.

The manner of taking whales at preſent is as follows. As ſoon as the fiſhermen hear the whale blow, they cry out *fall! fall!* and every ſhip gets out its long boat, in each of which there are ſix or ſeven men: they row till they come pretty near the whale, then the harpooner ſtrikes it with his harpoon. This requires great dexterity, for through the bone of his head there is no ſtriking, but near his ſpout there is a ſoft piece of fleſh, into which the iron ſinks with eaſe. As ſoon as he is ſtruck, they take care to give him rope enough, otherwiſe, when he goes down, as he frequently does, he would inevitably ſink the boat: this rope he draws with ſuch violence, that, if it were not well watered, it would by its friction againſt the ſides of the boat, be ſoon ſet on fire. The line faſtened to the harpoon is ſix or ſeven fathoms long, and is called the fore-runner: it is made of the fineſt and ſofteſt hemp, that it may ſlip the eaſier: to this they join a heap of lines of 90 or 100 fathoms each, and when there are not enough in one long-boat, they borrow from another. The man at the helm obſerves which way the rope goes, and ſteers the boat accordingly, that it may run exactly out before; for the whale runs away with the line with ſo much rapidity, that he would overſet the boat, if it were not kept ſtraight. When the whale is ſtuck, the other long-boats row before, and obſerve which way the line ſtands, and ſometimes pull it; if they feel it ſtiff, it is a ſign the whale ſtill pulls in ſtrength; but if it hangs looſe, and the boat lies equally high before and behind upon the water, they pull it in gently, but take care to coil it ſo, that the whale may have it again eaſily if he recovers ſtrength: they take care, however, not to give him too much line, becauſe he ſometimes entangles it about a rock, and pulls out the harpoon. The fat whales do not ſink as ſoon as dead, but the lean ones do, and come up ſome days afterwards.

As long as they ſee whales, they loſe no time in cutting up what they have taken, but keep fiſhing for others; when they ſee no more, or have taken enough, they begin with taking off the fat and whiſkers in the following manner. The whale being laſhed along ſide, they lay it on one ſide, and put two ropes, one at the head, and the other in the place of the tail, which together with the fins is ſtruck off, as ſoon as he is taken, to keep thoſe extremities above water. On the off ſide of the whale are two boats to receive the pieces of fat, utenſils and men that might otherwiſe fall into the water on that ſide. Theſe precautions being taken, three or four men with irons at their feet, to prevent ſlipping, get on the whale, and begin to cut out pieces of about three feet thick, and eight long, which are hauled up at the capſtane or windlaſs. When the fat is all got off, they cut off the whiſkers of the upper jaw with an ax. Before they cut, they are all laſhed to keep them firm, which alſo facilitates the cutting, and prevents them from falling into the ſea: when on board, five or ſix of them are bundled together, and properly ſtowed, and after all is got off, the carcaſs is turned adrift, and devoured by the bears, who are very fond of it. In proportion as the large pieces of fat are cut off, the reſt of the crew are employed in ſlicing them ſmaller, and picking out all the lean. When this is prepared, they ſtow it under the deck, where it lies till the fat of all the whales is on board; then cutting it ſtill ſmaller, they put it up in tubs in the hold, cramming them very full and cloſe. Nothing now remains but to ſail homewards, where the fat is to be boiled and melted down into train oil.

It were in vain to ſpeak in this place of the advantages that may be derived to Great Britain from the whale fiſhery. We ſhall only remark, that the legiſlature think that trade of ſo great importance, as to grant a very conſiderable bounty for the encouragement of it; for every Britiſh veſſel of 200 tons or upwards, bound to the Greenland-ſeas on the whale fiſhery, if found to be duly qualified according to the act, obtains a licenſe from the commiſſioners of the cuſtoms to proceed on ſuch voyage; and on the ſhip's return, the maſter and mate making oath that they proceeded on ſuch voyage and no other, and uſed all their endeavours to take whales, &c. and that all the whale fins, blubber, oil, &c. imported in their ſhip, were taken by their crew in thoſe ſeas, there ſhall be allowed forty ſhillings for every ton according to the admeaſurement of the ſhip.

WHALE-BONE, or, as it is otherwiſe called, whale-fins, in commerce, a commodity procured from the

whale, uſed as ſtiffening in ſtays, fans, buſks, ſkreens, &c. What we call whale-bone, or fins, is a horny laminæ in the upper-jaw of the balæna, which ſupply the place of teeth, but there are none ſuch in the lower jaw. Theſe laminæ are commonly called whiſkers, which, ſplit and faſhioned, are the whale-bone. The pizzle or genital member of the animal ſerves likewiſe for the ſame purpoſe.

WHARF, a ſpace on the banks of a haven, creek, or hithe, provided for the convenient loading and unloading veſſels upon.

The fee paid for the landing of goods on a wharf, or for ſhipping them off, is called wharfage, and the perſon who has the direction and overſight of the wharf, receives wharfage, &c. is called the wharfinger.

WHEAT, *Triticum*, the name of a well known plant, greatly cultivated in many parts of the world, eſpecially in England.

It has been very juſtly obſerved by the ancients, as well as moderns, that wheat will grow in almoſt any part of the world, and that, as it is the plant moſt neceſſary to mankind, ſo it is the moſt general, and the moſt fruitful. It thrives not only in temperate climates, but alſo in very hot, and very cold regions; and, when ſown in places where it never grew ſpontaneouſly, ſucceeds as well as where it has been always common. The ſucceſs of our crops of wheat in America plainly prove this: and in Peru and Chili in particular, where this grain was not known till the Europeans introduced it there, it now produces as large a crop as in moſt parts of Europe.

Wheat ſhould be ſowed in autumn, and always when the ground is moiſt. In the downs of Hampſhire, Wiltſhire, and Dorſetſhire, farmers begin to ſow their wheat in Auguſt, if any rain has fallen, and even employ their people to ſow one place, while they reap another, if wet weather interrupts them in their harveſt: for if the corn is not forward in autumn, ſo as to cover the ground before winter, it ſeldom does well on thoſe high dry lands, eſpecially if the enſuing ſpring prove likewiſe dry. In low ſtrong lands, ſome huſbandmen think they are in good ſeaſon, if they get their wheat into the ground by the middle of November; nay, it ſometimes is Chriſtmas, or even later, before all their wheat is ſown. But this late ſown wheat, beſides being apt to run too much to ſtraw, eſpecially if the ſpring be moiſt, is liable to be thrown out of the ground by froſts.

In general, all wheat ſucceeds beſt upon ſtrong ſoils, eſpecially if they have been well drained, ſo that the corn lies dry: but as ſome ſorts of this grain thrive better in ſome ſoils than in others, it might redound to the public welfare if more particular obſervations were judiciouſly made, in regard to each kind, than have hitherto been. The white egg-ſhell wheat is reckoned beſt for light lands, and to ſow with rye for meſlin; becauſe it ripens ſooneſt. It ſhould alſo be the earlieſt in the ground. This ſpecies is much ſown in Eſſex, upon their hazely brick-earths, or loams; as the red-wheat, and the Poland bearded wheat alſo is there, and in Hertfordſhire upon ſtiff yellow clays. The white Poland, or pole-rivet wheat has not a hollow ſtraw, and therefore is not ſo ſubject to lodge as other corn that has. This kind is particularly fit for lands where the crop is apt to run much to ſtraw.

In Oxfordſhire, they have a ſort of wheat which they call long coned-wheat, and reckon the beſt for rank clays. Its ſtraw not being hollow, it is the leſs liable to lodge; and farmers obſerve that it is the leaſt apt to be mildewed, or be eaten by birds, from which laſt it is greatly guarded by its long rough awns; but the flour of it is ſomewhat coarſe. Their white kind of red eared wheat has a white ear and a red grain, and is a very good ſort for clayey land. It yields a good crop, and ſeldom ſmuts.

In Staffordſhire, they reckon the red Lammas or bearded wheat the beſt for cold lands or ſtiff clays.

In Berkſhire is a wheat called pendulum-wheat, from the hanging of its ear, much like the cone-wheat.

In Northamptonſhire, they have a ſort of wheat with a white ſtraw and reddiſh ear and grain; much commended for the plumpneſs and largeneſs of the grain, and the ſtrength of the ſtraw, which prevents its being ſubject to lodge; nor is it apt to be eaten by birds. They have alſo a red eared bearded wheat, and a ſort of pollard or duck-bill wheat, as it is called, known in Suſſex by the name of fuller's wheat, which has ſo cloſe and thick a huſk, that the birds never injure it. Mr. Miller obſerves that this ſort of wheat grows very tall, and, if it be ſown too thick, is very apt to be lodged by rain and wind; for that its ears are large and heavy, and incline on one ſide as the grain increaſes in weight; but that, if its roots are at a proper diſtance from each other, it will tiller greatly and have ſtrong ſtalks, and that the grain of this wheat yields more flour in proportion than that of any other ſort. The awns of this wheat always drop off when the grain is full grown.

Smyrna wheat, commonly called many-eared wheat, becauſe ſeveral leſſer or collateral ears grow around the bottom of the main ear, which is very large in its ſtate of perfection, requires more nouriſhment than the common huſbandry in the large way can give it, and therefore is not cultivated by our farmers: but it would, probably, do extremely well in the horſe-hoeing huſbandry, where the quantity of food can be enlarged almoſt at pleaſure. For the ſame reaſon maiz, commonly called Turkey or Indian corn, is fitteſt for this laſt huſbandry.

Some gentlemen have been curious enough to procure their ſeed wheat from Sicily, and it has ſucceeded very well as to the growth: but the grain of this ſpecies has proved too hard for our Engliſh mills to grind.

The beſt time for ſowing wheat is about the beginning of September, eſpecially if any rain has fallen; a circumſtance ſo eſſential, that if the earth be very dry, the farmer had better ſtay till friendly ſhowers have moiſtened his ſoil, than put his corn in ground where it will not grow before it has been wet, let the time be ever ſo long. Mr. Mortimer ſays he has known wheat to be ſo muſtied and ſpoiled by laying long in the ground, before rain came, that it has never grown at all: to which he adds, that he has likewiſe ſeen very good crops of wheat from ſeed ſown in July. At all events, the huſbandman ſhould certainly have his wheat ſowing finiſhed by the middle of October. Whoever neglects this, ſhews in ſo doing, a want of proper œconomy in his affairs, and will have cauſe to repent the delay.

Early ſowings require leſs ſeed than late ones, becauſe the plants then riſe better, and acquire ſtrength to reſiſt the winter's cold. More ſeed ſhould always be allowed for poor lands than for rich, becauſe a greater number of plants will periſh on the former. Rich lands, ſowed early, require the leaſt ſeed of any.

Another circumſtance which the huſbandman ſhould carefully attend to in ſowing, is that his eſtimate of ſeed be formed, not from the capacity of any particular meaſure, but from the number of grains which that meaſure will contain; becauſe the grains of ſome growths of wheat are much larger than thoſe from off other lands, tho' of the ſame ſpecies, and perhaps equally good. By not conſidering this, the ground will of courſe frequently be ſown too thick, or too thin; tho' we believe farmers are ſeldom apt to run into this laſt extreme. That they too often commit the former error, ſo manifeſtly contrary to their intereſt in every reſpect, is demonſtrated by reaſon, and by daily experience:—but neither of theſe is ſufficient to make them deviate from the beaten track. Inſtead of the uſual allowance of three buſhels of ſeed wheat to an acre of land, repeated trials have ſhewn that half that quantity is generally more than ſufficient: conſequently a great deal of corn is actually thrown away; for the expence of purchaſing ſeed, which moſt ſkilful huſbandmen do, at leaſt every other year, amounts to a conſiderable article in large farms, and in a whole country, merits the attention of the public, eſpecially in ſcarce years: beſides which, the future plants, crowded together by being thus ſown too thick, and not having a ſufficient ſpace allowed them for their ſuſtenance, cannot yield near ſo fine and plentiful a crop as they would otherwiſe produce. A fair trial, made with proper care, would ſoon convince farmers of their error in this reſpect; for if they but examine a field of corn ſown in the com-

mon way, they will find few plants with more than two or three ſtalks, unleſs by chance, where ſome of them ſtand ſo as to have room to ſpread. Theſe will have ſix, eight, or ten ſtalks, and frequently many more: but a field of wheat ſown with only a buſhel of good corn has been known to be well covered with healthy vigorous plants, each of which has had from ſix to fourteen, or more, ſtalks, crowned with long well nouriſhed ears, full of fine plump grain, of which it has yielded a much greater quantity than any of the neighbouring grounds ſown with the common allowance. If the land is good, and the plants ſtand at a proper diſtance from each other, few of them will produce leſs than the above number of ſtalks and ears. But farmers think they ſhall have no crop if the ground is not covered with the blades of corn by the ſpring: whereas, if they would have patience to wait till the plants put out all their ſtems, they would be amply convinced of the contrary. Every one muſt have obſerved in places where foot-paths are made through corn-fields, that, by the ſide of thoſe paths, where the corn is thin, and has been trodden down in the winter and ſpring, the plants have ſtood erect, when moſt of the corn in the ſame field has been laid flat upon the ground; an advantage which can proceed from no other cauſe, than that their ſtalks are ſtronger from their having more room: for thoſe of the other plants are drawn up tall and ſlender by being too cloſe together.

More ſeed is commonly ſowed upon new broke up ground, than upon that which has been longer in tillage. From half an inch to three inches is the uſual depth at which wheat is planted, according to the nature of the ſoil; the ſtiffeſt lands requiring the ſhalloweſt ſowing, as was before obſerved. The general cuſtom is, to ſow it under furrow, which is certainly moſt adviſeable if the ſoil be ſhallow, to prevent the plants being thrown out by the winter's froſts, or their roots being left bare by the drying winds in the ſpring. Some ſow in broad caſt, either with a ſingle caſt, or a double bout, harrowing once between; after which the ground is again harrowed ſeveral times, till the ſeed is well covered. However, a great deal of it will become the prey of birds, in this manner of ſowing. On the other hand, in planting the corn deep, there is the greater danger of its being eaten off by worms between the grain and the blade.

Great care ſhould be taken to guard againſt the rooks juſt at the time when the wheat is ſhooting up. Theſe miſchievous birds perceive its ſprouting much ſooner than the farmer can, and are led by the ſhoot to pick it up. They muſt therefore be carefully kept off the ground for a week or ten days at this ſeaſon; for at the end of that time the blade will be grown up, and the grain ſo exhauſted of its ſubſtance, that they will not give themſelves any trouble about ſtealing it. They never moleſt the wheat which is ſown about Michaelmas; becauſe ſo much grain of the late harveſt then lies ſcattered about the fields, that they find it eaſier to pick up that, than to ſearch for corn under ground, in the new-ſown lands.

No part of huſbandry requires the farmer's attention more than keeping his land free from weeds; yet few trouble themſelves much about this eſſential article, are ſenſible of its importance, or underſtand the proper method of doing it: nay, many do not even know which weeds are annual, and which perennial; a diſtinction highly neceſſary to be made by every perſon who would keep his ground clean and in good order, and without which the greateſt induſtry will often be baffled. Annual weeds may be ſoon deſtroyed, if taken in time: but if they are neglected, their ſeeds will ripen, and ſow themſelves in ſuch abundance, that much additional labour and expence will be required to do that which might have been performed with eaſe at the beginning, without ſubjecting the corn to be robbed of its nouriſhment by bad neighbours. The common method of weeding is very abſurd: for in that practice the weeds are left to grow till the wheat begins to ear, and they are in flower; by which means, the ground being covered by the corn, all the low weeds are hid, left to ripen, and ſcatter their ſeeds: only the tall weeds are taken out; and if the people employed are not careful, many of theſe will eſcape them, by being ſo intermixed with the ſtalks of the wheat, as not inſtantly to be diſtinguiſhed. At the ſame time great numbers of the plants of wheat are broken and trod under foot by the weeders.

To obviate theſe inconveniences, Mr. Miller recommends the method now practiſed by good kitchen gardeners, who clear their ground with a ſmall kind of hoe, which, if uſed among the wheat early in the ſpring, before the ground is covered by the blades of corn, will effectually eradicate all the weeds, eſpecially if this work be done in dry weather; becauſe, being ſmall, they then ſoon wither and die. If the ground happens to be very full of weeds, it may be neceſſary to go over it a ſecond time, about a fortnight after the firſt, to cut up thoſe which may have been too ſmall to be noticed. By this means the corn will be kept clean, freed from robbers which would deprive it of due nouriſhment, and there will not be time for new weeds to grow ſo as afterwards to do it any great prejudice: for the ground will be ſo much ſhaded by the corn, that the weeds will thereby be kept down, in ſuch manner as not to ripen their ſeeds before harveſt.

If, at the time of this operation, ſome of the plants of corn are cut up where they grow too cloſe, the reſt will be greatly benefited thereby: but in this, adds Mr. Miller, I fear that few of the old farmers will ever agree with me, though what I mention is not from theory, but from experiments, repeated with great care, and ſuch ſucceſs that the produce of twenty rods of ground was much greater, both in weight and meaſure, than that of the ſame extent in the very beſt part of the field, where this was not practiſed; and the ſtalks of the corn thus thinned ſtood upright, when a great part of the crop in the ſame field was lodged.

Both the advantage of having the plants of corn at proper diſtances from each other, and that of keeping them quite free from weeds, too difficult, not to ſay almoſt impracticable, taſks to be completely effected in the common method of ſowing, are fully obtained in the New huſbandry, as will ſoon be evidently ſhewn.

M. Duhamel and Mr. Miller juſtly blame the practice of thoſe who either turn hogs in among their wheat, to deſtroy part of it when it grows too thick; or ſheep to eat it down, when they think it too rank. The abſurdity of the former is ſelf evident: and in regard to the latter, it is well known, from long experience, that the leaves, or blades, of corn are neceſſary to draw in nouriſhment from the air and dews, for the increaſe of the ſtalk and ear. To be thoroughly ſatisfied in this, Mr. Miller cut off the leaves of ſome plants of wheat, alternately, early in the ſpring, and always found the ſtalks of theſe plants much ſmaller, the ears ſhorter, and the grain poorer, than thoſe of the intermediate plants whoſe blades were not cut. Several experiments made by M. Duhamel have proved, not only that all plants are impeded in their growth, and rendered leſs perfect in their productions, but often even killed, by ſtripping them of their leaves: and this is confirmed by Mr. Miller, who adds, that he has frequently obſerved in gardens that plants diveſted only of their lower leaves, plucked off by ignorant perſons upon a ſuppoſition of their drawing the nouriſhment from the head, have been greatly weakened thereby. The ſame will undoubtedly hold good with reſpect to corn: beſides which, cattle, and particularly ſheep, will often bite ſo cloſe as to deſtroy the crown of the plant, from whence its future growth ſhould proceed.

Wheat is ripe when its ſtraw is turned yellow, its ears hang, no greenneſs appears in the middle of them, and the grain is hard when bitten. From four to five quarters is reckoned a good crop: but ſome would hardly credit how much beyond this the produce of good ground, thoroughly well cultivated, may be increaſed.—Thoſe who are ſenſible of the vaſt advantages of a perfect culture, will not be ſurpriſed at Mr. Miller's aſſuring us that he has known eight and ten quarters, and ſometimes more, reaped from an acre, over the whole field, where the corn has ſtood thin upon the ground; and that he has been informed by perſons of great credit,

credit, that even twelve quarters have been reaped from an acre of land drilled and managed with the horſe-hoe.

Both wheat and rye may be cut ſomewhat before they are thoroughly ripe, eſpecially if they be lodged; for if the ſtraw be broken, it will no longer convey any nouriſhment to the grain. M. Duhamel ſeems to think this even the moſt eligible way for wheat, becauſe the grain will harden afterwards in the ſheaf; whereas, if it be let ſtand till it is too ripe, it will ſhed greatly in cutting, binding, and carrying home. It is partly to prevent this inconvenience, that good huſbandmen tie it in the evening, and carry it off early the next morning. The ancients reaped their corn before it was full ripe, as Pliny informs us. And indeed it muſt be allowed that very great diſadvantages neceſſarily attend the letting of ſome ſorts of corn ſtand till their grains have acquired their utmoſt maturity. Both the chaff and the fodder are the worſe for it; and, if ſuch ripe corn takes wet, the increaſe in malt is loſt, if it be barley, it having already ſpent itſelf; and if it be wheat, the quality of the flour is greatly impaired, as well as the quantity conſiderably leſſened. But if corn be cut greeniſh, it will bear a pretty deal of wet without damage; for it will not imbibe the water like full ripe corn, but only take in ſo much as to be kindly fed thereby. Again, if any ſort of corn be blighted, the ſooner it is cut down, though but half ripe, the better it will be; for nouriſhment can no longer be conveyed to it by the ſtraw; but it will be fed by lying in the ear. The ſtraw would become more and more brittle, by ſtanding till the corn is ripe; and the grain comes the clearer from the huſk, when threſhed, if this blighted ſort be cut early.

One man, with a binder, may reap an acre of wheat and ſomewhat more of rye, in a day, if the corn ſtand well: he will alſo clear about an acre of peas, vetches, &c. in the ſame ſpace of time.

"The huſbandman, ſays M. Duhamel, cannot have a more favourable ſeaſon to get in his harveſt, than that which is afforded him by hot and dry weather: for the quality of the corn is improved, and the grain is rendered much fitter to keep, by the ſun's having acted powerfully upon it, either towards the latter part of its ſtanding, or juſt after it has been cut: though it is true, on the other hand, that this very circumſtance renders the ears more apt to ſhed their grain, and that the value of a ſowing is often loſt thereby. To prevent this, as much as poſſible, the corn is firſt laid in gripps, and then tied up in ſheaves, in the cool of the evening, or early in the morning before the heat comes on; and the mowers of oats frequently work during part of the night, to avoid the exceſſively fatiguing ſultrineſs of the noon. Theſe poor people, whoſe taſk is infinitely laborious, are liable to many grievous diſorders; eſpecially the reapers, who, being obliged to ſtoop to their work, almoſt to the very point where the rays of the ſun are moſt violently reflected by the earth, breathe a perfectly burning air. This forces them to drink copiouſly of liquors, which, being heated by the ſun, allay their thirſt only for a few moments, and, I ſtrongly ſuſpect, often occaſion ſevere illneſſes: the inventing of a machine, engine, or inſtrument, by which the hardneſs of this labour might be mitigated, would therefore be a truly uſeful diſcovery; and I moſt heartily exhort all ingenious perſons who have a mechanic turn, ſeriouſly to think of it.

"The two uſual ways of cutting corn, are either with the ſcythe, or with the ſickle. The former is commonly uſed for oats and barley, or, ſometimes, for very thin, ſhort wheat; and the ſickle is generally appropriated to the reaping of tall and thick wheat and rye. The ſcythe diſpatches ſo much more work than the ſickle, that the difference of expence between reaping an acre, or mowing it, is nearly in the proportion of five to two.

"Every part of the mower's body labours and fatigues, and his work requires greater dexterity than that of the reaper: but as the mower is always in a kind of ſtanding poſture, he has the advantage of being refreſhed by every breeze of air; which the reaper, for the reaſons before-mentioned, has not.

"I do not deſpair but that ſome engine may, one time or other, be found out, to eaſe theſe very hard labourers, and expedite their work. In the mean time I am perſuaded that the following account, written by Mr. Lille, of what himſelf has practiſed on his own eſtate, will afford the reader ſufficient ſatisfaction, and it will be juſtice to obſerve, that he does not relate matters of mere ſpeculation, but real facts; things actually executed by himſelf, and which I ſhould certainly have tried, could I poſſibly have been in the country when our harveſts were got in.

M. de Lille's account of his method of mowing WHEAT.

"When I firſt put a ſcythe to my corn, I was of courſe laughed at by ſome of my neighbours, becauſe they had never ſeen any ſuch thing. I let them enjoy their pleaſantry; but perſevered in my undertaking, which I have now practiſed ſufficiently to be able to point out minutely its advantages, and its inconveniences; for I allow that, though the former are very great and numerous, it is alſo attended with ſome of the latter.

"The year 1751 was very rainy, our graſs rotted upon the ground, our corn was poor and infeſted with weeds; and the weather continued extremely bad during all the harveſt ſeaſon. One of my fields of wheat, containing about fifteen acres, was, in particular, in ſuch wretched plight, that I did not think the crop worth taking off. However, after walking over it, and viewing it on every ſide, I found that the quantity of graſs and other growths upon it, might, if mowed, afford a great deal of fodder, which would make me ſome amends for the total loſs of my lucerne. I therefore determined to let my horſes have it all, with the little wheat which appeared here and there. This firſt made me think of mowing a field of wheat; tho' I ſoon recollected that I had met with the hint before, in ſome of your writings. Accordingly, I ſet my mowers to work: my field yielded a great quantity of fodder; the graſs, mowed within two inches of the ground, ſhot up anew, and afforded excellent paſture; and laſtly, my bailiff, more ſaving than I had been, ordered the truſſes to be threſhed, and got out of them as much wheat as was yielded by other grounds.

"Whilſt I was congratulating myſelf upon the ſucceſs of my operation, by which my horſes and cattle were provided with plenty of fodder for the next winter, I learnt that the huſbandmen in Hainault, Flanders, Artois, and other adjacent parts, never cut their corn down otherwiſe than with a ſcythe; but at the ſame time I was informed, that they do not mow wheat in the ſame manner as oats; that the ſcythes are not made alike for both theſe works, and that there are ſome other eſſential differences.

"Theſe obſervations were a ſort of proof that the practice had been found to anſwer, ſince it was ſtill continued; and I concluded, that if my operation, imperfect as it was, had ſucceeded ſo well, I might expect far greater advantages when it ſhould be performed regularly: but, not to be too ſtrongly prejudiced in its favour, I reſolved to make a trial upon about thirty acres only.

"By dint of inquiry I found within a few miles of me a huſbandman who came from the province of Artois, and had been uſed to this very buſineſs. I talked with him; he told me how the work ought to be done, pointed out its advantages, and I retained him for my intended next year's mowing of wheat; but as the ſeaſon was pretty far advanced, and there was not time to procure from his country other people equally well acquainted with the practice, to follow the ſcythe, and to do the whole completely in every reſpect, he inſtructed two young lads, as well as he could. In ſhort, nothing was wanting but a mere matter of form, by the neglecting of which ſome of the lifts of the cut corn were miſplaced, ſo that there were ears at both ends of the ſheaf.

"I ought not here to forget the clamour raiſed by this novelty. I made the experiment upon my fineſt wheat; becauſe my new workman had told me, that the ſtronger the corn was, the better and more regularly the mowing would be performed. My neighbouring huſbandmen, and all the reapers employed by them, thought me out of

my ſenſes, and ſome of them even came to reaſon the matter with me. They meant well, and I took it kindly; but deſired them carefully to notice the event.

"My experiment was made upon three pieces of wheat, of ten acres each, ſituated in much more extenſive fields of the ſame corn; ſo that there was the faireſt room to make a juſt compariſon between the operation of the ſcythe and that of the ſickle.

"Some of the neighbouring huſbandmen had the curioſity to ſee the work performed, and were ſurpriſed to find that leſs corn was ſhed in this way, than in the common practice of reaping with the ſickle. They thought the method good; but made a few objections to ſome particular circumſtances, in which the experience of ſubſequent years ſhewed them that they were wrong. Their entire approbation then followed; and their mowers, finding that they ſhould be able by this means to cut down all their corn without the aſſiſtance of ſtrolling ſtrangers who often do their work very badly, gladly learnt the new method, and commended it to others.

"This trial ſucceeded ſo well, that I reſolved to cut all my crops in the ſame manner; and that nothing might be wanting to perfect my mowers in this practice, I procured a ſufficient number of expert workmen, maſters of the art, from the village of Trie, near Valenciennes, to aſſiſt and inſtruct them for the harveſt of 1753.

"This work required a precaution which has been duly attended to ever ſince: it is, to pick all the ſtones from off the land, every year, as carefully as poſſible. The expence of ſo doing is a very trifle, when compared to the advantages attending it. All the roads around my land, which were formerly impaſſible in winter, are now firm and good, fit for any carriage. We no longer hear of horſes lamed, or waggons overturned by them; and, which is equally true, I find that my ground now requires a leſs quantity of ſeed.

"I have now practiſed this method, in an extenſive manner, during five ſucceſſive years, in the courſe of which, I have had opportunities of experiencing every circumſtance neceſſary to be conſidered in order to determine its real merit; I mean, mowing in rainy weather, and cutting of corn either bent, laid flat, totally lodged or lodged only in particular places, and in various directions. I ſhall firſt deſcribe the mechaniſm of this mowing, and then point out its advantages, with the objections of my neighbours, which will ſhew the only inconveniencies I have met with.

"The Flemiſh mowers whom I employed in the year 1753, brought with them ſcythes exactly like ours. I ſaw no ſort of difference in their ſize, make, manner of being mounted, or even in the hooks they were trimmed with; ſo that I found I had been miſinformed by thoſe who told me in 1751, that this work required an inſtrument different from that which is uſed for mowing oats. It was not till the year 1755, that an ingenious workman pointed out ſome very proper alterations, which have ſince been made.

"This intelligent mower obſerved that the common ſcythe cannot ſuit any ground but ſuch as has been plowed flat; that it therefore was leaſt of all proper for our lands, which are plowed in ridges of ten or twelve furrows, raiſed very high in the middle; and that its hooks broke the ſtraw, plucked off numbers of ears, and did not lay hold of many ſhort plants which grow in the bottom of the furrows, whereby a loſs was occaſioned, or take up the intermixed graſs and weeds ſo exactly as might be wiſhed. To remedy this, he took a ſcythe at leaſt ſix inches ſhorter than thoſe which are commonly uſed, and, inſtead of the hooks, ſubſtituted what he calls the bender, conſiſting of two ſhoots of willow, or other green wood, placed ſemicircularly upon the handle of the ſcythe, where the hooks are commonly ſet. To this end, there muſt be four holes in the handle, ſo that the end of one twig may be put into the lowermoſt hole, and its other end into the third, and the two ends of the other twig into the ſecond and fourth holes. The ſcythe thus trimmed is to be uſed in the manner I ſhall now explain.

"When a mower ſets about cutting down a crop of oats, he places himſelf ſo that the corn is at his right-hand, from whence the action of the ſcythe throws the waving towards his left. The mower of wheat, on the contrary, proceeds from outſide to inſide, ſo that the corn which he is next to cut is always at his left hand; and that which he has juſt cut, being collected by the bender, is reſted, inclining a little, againſt the adjoining uncut part.

"A helper, which may be a boy of twelve or fifteen years of age, or an elderly woman, follows the mower at the diſtance of four or five feet, with a reaping hook, or a ſtick about a foot and a half or two feet long, and, by putting that through the interval between the ſloping late cut wheat, and the ſtanding corn againſt which it reſts, takes up the former, gives the ſtraw ends a gentle ſtroke or two upon the ground, to form that parcel into a grip, and lays it down at his right hand. This ſhould be done very expeditiouſly, becauſe the picker-up, as this perſon is called, is followed by another mower; and it ſhould alſo be done dexterouſly, becauſe the greater or leſs quantity of gleanings depend thereon. There ſhould be as many pickers-up (we call them binders), as there are mowers.

"The poſture of the mower is a circumſtance of ſuch importance, that I think myſelf happy in having taken particular notice of it in 1754. In cutting graſs and oats, the mower goes in ſuch manner that his feet, which are moved alternately at each ſtroke of the ſcythe, deſcribe two parallel lines. But in the mowing of wheat, the mower's track ſhould be upon a ſingle line, ſo that his right foot, which ſhould be foremoſt, be driven forward by the left, at each cut of the ſcythe; not unlike the attitude of a fencer when he advances.

"An accident, which had like to have over-ſet my whole operation in the year 1754, demonſtrated to me the neceſſity of this different poſture. I employed for mowing my wheat, men who uſed to come yearly to cut down my oats: they were ſeven in number. On the third day of their labour, five of them fell ill; upon which I ſet three others to work; but the conſequence was, that I had ten ſick people to take care of at the end of the week. I viſited them, inquired into their ailments, and found, that ſome of them had a fever, but that all complained of violent pains and ſoreneſs under their left ribs. At firſt, I inclined to think them pleuritic; but upon a cloſer examination, and upon conſidering the nature of the work they had been at, I ſaw their illneſs had proceeded from badly managed hard labour, the ſtreſs of which had been made to lie chiefly upon the left ſide. I therefore ordered them to take their reſt.

"The next day upon viſiting my infirmary, I found that two of the mowers were returned to their work. I went out to them, and ſaw, even at ſome diſtance, that their poſture in this work was the ſame as if they had been mowing of oats. This immediately ſhewed me the cauſe of their pains. The ſcythes which they then uſed had the common ſort of hooks, and were much heavier than thoſe with only wicker benders. I took up one of them, put myſelf in the poſture of a mower of oats, and ſhewed them, that as a much greater weight reſted upon the hooks of the ſcythe when they mowed wheat, than when they cut oats; it was not poſſible for them, in the poſture they had choſen, to move that increaſed load to the left, without an irkſome twiſting of the body. Then, putting myſelf in the poſture of a fencer, as I had ſeen my Flemiſh mowers do the year before, I demonſtrated to them, that the body was thereby placed in ſuch an attitude as enabled it to exert the greateſt ſtrength, when, by the motion from right to left, it had the greateſt load to ſupport, and that, by the ſame means, this load was carried round without fatiguing the ribs of either ſide. My man took back his ſcythe, tried as I had directed, was convinced of the truth of my demonſtration, taught his companions the ſame method, and they have done their buſineſs eaſily ever ſince. I thought it neceſſary to relate the circumſtances of this accident, becauſe I am ſatisfied that even the ſtrongeſt men would ſink under the labour of mowing wheat, if they were to ſtand in the ſame poſture as the mowers of oats.

"Such is the manner in which this operation ſhould be performed, when the corn ſtands upright, that is to ſay, in the moſt favourable years. I ought to add, that the mower ſhould take care to place himſelf for his work,

in ſuch manner, that his left hand may be toward the wind. The corn is then naturally inclined over the ſcythe, and is the more eaſily cut cloſer to the ground. The reſiſtance of the wind, be it ever ſo little, helps to keep the corn which is cut ſteady upon the benders of the ſcythe, and facilitates the motion which reſts it againſt the uncut corn, where the binder takes it.

"The mower is not hindered from mowing cloſe, by the wind's blowing at his back; but the corn which he cuts will not be ſo exactly collected by the bender: ſome of the ears will be a little ſcattered: but the greateſt inconvenience is, that it does not reſt ſo well againſt the ſtanding corn, but is often blown down; which renders the binder's work ſlower, and more troubleſome, and occaſions greater gleanings.

"The wind is in a bad corner for the mower when it blows in his face. It then occaſions a loſs of ſtubble, and a great diſperſion of the ears.

"But the worſt of all winds for this work, is that which blows upon the right hand of the mower. The ſtubble then remains long, and ſo great a quantity of ears lies ſcattered about, that one would hardly think the ground had been harveſted. My mowers did not place themſelves in this manner of their own accord; but I made them do it for a quarter of an hour, to try the effect, of which I am fully convinced.

"When the corn is inclined, or bent, the mower takes it in the direction of its bending, from left to right; which has the ſame effect, in calm weather, as if the wind blew towards his left.

"Corn which is lodged cannot eaſily be mowed inward, becauſe the binder would be inceſſantly impeded by the intangling of his grip with the un-cut corn. A good mower judges by his eye, which part it is moſt proper to begin at, and takes advantage of the wind when it can be of ſervice to him. The method which I have ſeen moſt commonly practiſed, has been by taking the corn in the direction of its bending, and throwing it in waves. The work thus done is neatly performed: no remains of ſtubble are ſeen after the mowing; but the field looks like a meadow.

"Corn laid abſolutely flat, and intangled, is the moſt difficult to cut well. I have ſeen a mower take it in every various direction in which it was beaten down, as if the wind had been conſtantly at his back, and by this means he has cut as cloſe as if it had been only lodged. My wheat was in this condition in the year 1757, and was mowed very regularly: only the work was ſomewhat longer about, than it generally is in other caſes.

"I ſhall not ſpeak of rainy ſeaſons till I come to the objections againſt this method of cutting corn; becauſe they have nothing to do with our mowing, and the only thing requiſite in ſuch caſes is to keep the corn from ſprouting in the ear: but I ſhall here relate the advantages which I find in this practice.

"The preſervation of my fellow creatures is ſo dear to me, that I look upon the means of leſſening their exceſſive hard labour at a time when the heat alone is enough to over-power them, as the firſt and greateſt advantage reſulting from this method. Now I ſee that a good reaper, with his ſickle, can ſcarcely cut an acre of wheat in a day, let him toil ever ſo much; whilſt the mower will diſpatch from an acre and a half to upwards of two acres, according to his ſkill and dexterity. I have, indeed, met with but few able to exceed two acres, when they have done their buſineſs well; but we may reckon that a good mower, taking them one with another, and the corn as it runs upright, lodged, intangled, &c. will clear an acre and a half, or perhaps an acre and three quarters in a day, neatly, and without waſting any of it.

This mower does then three fifths more work than a reaper can. It is true, he has not the grips to tie up, becauſe the perſon who follows him does that part: but he is obliged to whet his ſcythe when he comes to the end of the field, and ſtill oftener when the corn does not grow thick; beſides which, notwithſtanding all the care that can be taken to clear the ground of ſtones, not a day will paſs without his meeting ſome, which will oblige him to have his ſcythe new hammered; and laſtly, when he has finiſhed a row, he muſt go back to the other end of the field before he can begin another. All this takes up at leaſt as much time as the reaper's binding up what he has cut: and in regard to the hardneſs of the labour on each ſide, I believe that every one who rightly conſiders the nature of their reſpective works, and their poſtures in working, will allow, that the mower's toil and fatigue is three-fifths leſs than that of the reaper.

"Another circumſtance well worth attending to, in this method, is, that the mower is not expoſed to thoſe injuries from thiſtles, thorns, and other noxious plants, which often prove fatal to the reaper.

"From the firſt of theſe advantages reſult ſeveral benefits: 1. A greater riddance of the neceſſary work. Not a year paſſes without the huſbandman's experiencing that ſome part or other of his corn ripens too ſuddenly; and this unexpected maturity, being exceedingly heightened by the leaſt delay, occaſions a great waſte, by the ſhedding of the grain, both when the crop is reaped with the ſickle, and in loading and un-loading it when carried home: whereas the ſcythe, by clearing in two days a field which could not be reaped in leſs than five, in the common way, guards againſt that exceſſive ripeneſs.

"2. This method of cutting down the corn requires fewer workmen.—I muſt here explain myſelf; becauſe the fact would contradict me, if it be objected that a mower and a binder are neceſſary in this way, for what the reaper alone does in the other. But I conſider, that to haveſt ninety acres, for example, of wheat, I muſt employ ten men at leaſt twenty days, with the ſickle; whilſt ſeven mowers and their binders (fourteen people) eaſily do my buſineſs in ten days. The difference then is equal to ſixty days work of one man; and if I do not intend to get my harveſt in quicker with the ſcythe than with the ſickle, I take but four mowers and four binders, eight perſons, of which the four laſt ſtand me in leſs expence than three reapers; becauſe I employ for this buſineſs young people, who would not be ſtrong enough to reap with the ſickle. Conſequently I have two workmen the leſs, and ſome advantage in the compariſon between the grown-up man, who has a higher price, and the lad, who anſwers my purpoſe.

"3. The thus employing of children, old women, and men whoſe conſtitution is not robuſt, would be an advantage to the inhabitants of the place. It would afford the means of ſubſiſtence to a greater number of people, and prevent idleneſs and beggary; an important object upon many accounts. Almoſt every pariſh would find within itſelf hands enough to get in its harveſt, without being obliged to have recourſe to accidental paſſengers, who often work badly, require exorbitant wages, and ſometimes leave their maſters in the middle of the harveſt, if they do not ſubmit to their unconſcionable demands.

"Let us leave ſpeculation, and notice ſome advantages which are evident beyond contradiction. 1. It is not a ſmall one to have a greater quantity of ſtraw, and that ſtraw intermixed with more graſs and other fodder, than when the corn is reaped in the uſual way. This does not need any proof; for every one knows, that the ſcythe cuts as cloſe to the ground as the mower pleaſes. Experience has ſhewn me, that the ſtubble has not been left two inches long upon our mowed fields, where the ſtones had been carefully picked off; whilſt the ſickle generally leaves it eight or nine inches long, and ſometimes much more when the ground is infeſted with thiſtles and other ſtubborn growths, which make the reaper lift up his hand to avoid them. The ſtraw is therefore plainly ſix inches longer when cut with the ſcythe, than with the ſickle; a difference which may be valued at a ſixth part more than that which is uſually reaped in the common way.

"2. The green fodder in the mowed fields ſhoots up anew when cut, and affords excellent paſture after the corn is taken off. The ſame demonſtrative evidence as before, will again take place here with thoſe who but conſider, that the reaper, leaving the ſtubble either eight or nine inches long, takes off only the very tips of the graſs which chances to be within his grip; ſo that, being then near its time of maturity, it ripens its ſeeds, ſows them, and withers away: whereas, when the ſcythe

cuts it within two inches of the ground, in its greeneſt and moſt un-ripe part, the yet remaining eyes, and the crowns of the roots, ſend forth new ſhoots, which form a good after-crop for cattle.

" 3. The paſture upon fields mowed with the ſcythe, is attended with an advantage, in regard to cows, which may perhaps be peculiar to my country. I know not whether it be the ſame elſewhere. We find every year, and I have always taken particular notice of it, that our cows ceaſe to yield milk during the firſt week of their feeding among the wheat ſtubble. I take the reaſon of this to be, that the ſtubble gets into their noſtrils, pricks them, hinders them from feeding, and makes them range the whole field over in queſt of graſs unattended with this irkſome inconvenience; ſo that they ſpend their time in running about, without grazing. I do not find that this accident happens to cows which are turned in among the ſhort ſtubble left by the ſcythe: the graſs there ſoon ſhoots up a-new, and yields me plenty of paſture, eſpecially if a little rain happens to fall after harveſt.

" It reſults from hence, that the huſbandman is enabled to feed more cattle than he could otherwiſe do, to ſave his ſainfoin or lucerne, and to have a greater quantity of dung; as I have experienced with almoſt incredible ſucceſs.

" I now proceed to the objections, which I ſhall ſtate in the ſame order as they were made; that is to ſay, as each year gave room for one or other of them.

" The firſt was, that the ſcythe muſt make the corn ſhed very much by ſhaking it conſiderably. To affirm the contrary may ſeem paradoxical; though the aſſertion will be proved from manifeſt principles, and by facts. To judge rightly of my propoſition, it will be neceſſary to compare the operation of the ſcythe with that of the ſickle; both of which I have examined very attentively.

" The reaper preſents his hand to the corn, and with wide extended fingers graſps as much as he poſſibly can; after which, to bring the lower part of the ſtalks ſo cloſe together that the ſickle may encompaſs the whole of his grip, and at the ſame time to give it a tenſion which renders the action of the ſickle more certain, he gives it a violent ſhake, and at that inſtant cuts it. The grip thus cut is generally entangled with the ſtanding corn; or the reaper, when going to lay it down, finds that he has miſſed cutting a ſtalk, or perhaps more, which he then breaks with a jerk of his hand. Thus ſeveral ſhakes precede that which the corn receives afterward when it is tied up.

" The ſcythe has not theſe effects. I have already explained the mechaniſm of its operation, and ſhewn that the corn, cut without any violent ſhake, is carried gently by the bender (or cradle, as we more commonly call it) upon the ſcythe, to the ſtanding corn, againſt which it reſts inclined, till the binder takes it away to tie it up.

" To prove my propoſition by facts, I inſtance the following. After my wheat was mowed in the year 1752, in the manner before related, upon the three ſeveral ſpots of ten acres each, which were parts of much larger fields, I went, with four other perſons, purpoſely to examine with all the care we could, what quantity of grain might have been ſhed by the mowing. We found none at all in the two firſt mowed pieces; but a great deal in the other parts of the ſame fields which had been reaped with the ſickle. In the laſt piece, which was not cut till the corn was riper, we found a little grain in the mowed part, but incomparably more in the other. I did not repeat this ſearch every year with the ſame care, becauſe I had not always the ſame conveniencies of making a compariſon: but I have ſeen enough to be certain that no grain is ſhed unleſs the corn be exceeding ripe, and that much leſs is then loſt by the ſcythe, than by the ſickle.

" The following more important objection was afterward made by a ſenſible huſbandman, who obſerved to me, that, in a rainy year, the corn cut after this manner muſt be more liable to grow in the ear, than that which is reaped in the common way, becauſe the heads of the grips not being ſupported here by a pretty high ſtubble, the wet cannot well drain off; and that the grain will imbibe a great deal of moiſture from the graſs underneath, when the ear is beaten down upon it by rain, which will render it very apt to ſprout as ſoon as the ſun ſhines upon it. I had been told how to guard againſt this accident, but did not try the method till the year 1756, when it anſwered perfectly well.

" This method conſiſts in laying the grips in a triangular form, ſo that the head of one reſts upon the foot of another. This operation is neither long nor fatiguing; nor does it require, in order to do it quick, any thing more than a little dexterity in cloſing the triangle, by making the foot of the third grip ſupport the ears of the firſt. The rains which fell during the harveſt of 1756, rendering the getting in of that year's crops extremely troubleſome, my neighbours had a great deal of ſprouted corn; but mine eſcaped by this method; and what little I had proceeded from that which remained un-mowed when the rain became inceſſant.

" With regard to the ſheaves, when bound, my Flemiſh mowers informed me, in 1753, of their practice when they are overtaken by laſting rains. It is, to heap upon one another, ends to ends, as many ſheaves as they can poſſibly cover with one, which is then opened and laid over them. My people did not practiſe this method, which I believe the beſt; but they ſecured my corn by other means, which anſwer extremely well, and are generally known.

" From the above objection my huſbandman derived another, relative to the difficulty of drying the graſs and weeds intermixed with the corn, in rainy years, and the danger of houſing the ſheaves when full of that traſh, which may ferment, and be the occaſion of the rotting of a whole pile of wheat. I cannot anſwer this objection otherwiſe than by my experience. The harveſts of 1756 and 1757 were certainly not favoured by the weather: yet all the wild growths which were cut down with, and bound up among the ſheaves, were well withered when they were houſed. No ſort of ſmell which indicated the leaſt fermentation was perceived in any of my barns; the threſhers did not find any thing that looked like it; and the ſtraw which is taken from thoſe barns, to feed my horſes, atteſts that there was not any.

" I now come to the laſt objection; by ſo much the more ſerious, as it is one of thoſe inconveniencies which I cannot remedy, but to which I readily ſubmit. The ears of the corn, ſay the objectors, do not lie ſo even in your grips, as in thoſe which are reaped with the ſickle; ſome of them are in the middle, and others at the very bottom of the ſheaf; ſo that your corn is not threſhed ſo well or ſo regularly, and you thereby loſe perhaps a conſiderable part of it. 2. All the graſs and weeds contained in your ſheaves are threſhed with the wheat, and their ſeeds are mingled with the corn when the threſher meaſures it out; conſequently you pay him for threſhing this traſh, which again increaſes the labour and pay of the winnower.

" All this is true: but let us diſcuſs the matter a little more thoroughly. There are ears in the middle and at the bottom of my ſheaves; but they ſeldom are of any other kind than thoſe which we call backward or late ears; the weak productions of ſickly plants, or of ſeeds not perfecty ſound. Repeated examinations have convinced me, that very few others are in this caſe; and theſe ears hardly part with their grain at any time, in whatever manner they are threſhed; for though the grains be torn from off them by the action of the flail, the inmoſt huſk ſtill adheres to the corn. Theſe diminutive imperfect grains are ſo great a detriment to the fine, plump, well nouriſhed corn, that they leſſen its value, if not carefully ſeparated by winnowing; after which they ſerve to feed poultry. If theſe ears eſcape the flail, the ſtraw is ſo much the better. Our horſes and other cattle reap therefrom a benefit which we ought not to grudge, becauſe, I think, it turns to our advantage.

" The threſhed graſs, and other wild productions, do indeed yield a conſiderable quantity of what are commonly called bad or uſeleſs ſeeds, for the beating out of which I pay the threſher. But the graſs which occaſions this expence, ſaves me that of a great deal of ſain-

foin and lucern, which my cattle would conſume: and it would be unjuſt in me to complain of the additional charge in the winnowing, ſince my manager has thought of applying thoſe ſeeds to domeſtic purpoſes, ſuch as feeding fowls, &c. which prove more profitable to me than an equal quantity of the fineſt corn.

"A real increaſe of expence, is what I pay the threſher beyond the common price of the country. This difference, which conſiſts in two-pence or three-pence for a quarter of wheat, is but a juſt compenſation for his extraordinary trouble in unbinding and binding up again perhaps an hundred and fifty ſheaves, and ſometimes more, for what an hundred ſheaves generally yield, when reaped in the common way. But this expence is ſo amply repaid by the extraordinary quantity of ſtraw obtained by my method, that I rate the difference at more than the value of five quarters of corn, which to ſilence contradiction, I will ſuppoſe to be otherwiſe loſt in my practice. Still my crop is cut down and houſed with far leſs toil and expence, than if it was reaped."

We ſhall conclude this article with the following comparative calculation of expence and profit between the drill and the common huſbandry, taken from Mr. Baker's report to the Dublin Society of his experiments in agriculture, for the year 1765, publiſhed by order of the Society.

An Eſtimate of the Expence upon a Plantation Acre of Wheat, in the common Huſbandry.

	l.	s.	d.
To the firſt plowing, commonly called breaking, for fallow, eight horſes eight ſhillings; two plowmen one ſhilling and four-pence; two drivers one ſhilling	0	10	4
To the firſt harrowing, four horſes four ſhillings; a driver ſix-pence	0	4	6
To the ſecond plowing, commonly called gaurowing	0	10	4
To the ſecond harrowing	0	4	6
To the third plowing, commonly called ſtretching	0	10	4
To ſowing the ſeed, eight horſes eight ſhillings; two plow-men one ſhilling and four-pence; two drivers one ſhilling; the ſeed-man eight-pence	0	11	0
To ſeed wheat, one barrel	1	0	0
To rent for the year of fallow	0	18	0
To ditto, the year the crop is growing	0	18	0
	5	7	0

In this account forty ſhillings are charged for forty horſes, employed in the culture of one acre for wheat, in the common huſbandry; a charge which ought to be conſidered by the farmer, for he actually buys and maintains his horſes for this buſineſs.

The crop which follows wheat is generally oats; but ſometimes peas are ſown inſtead of oats; with ſome, the practice is to let the peas follow oats; in which caſe they fallow only every fourth year; but where land receives no other aſſiſtance than what ariſes from fallow, it is a bad practice not to fallow every third year. It is the general practice to plow but once for oats, and therefore it ſhall be ſtated ſo; but it is a much better practice to plow the wheat ſtubble once before winter, and again in the ſpring.

An Eſtimate of Expence upon an Acre of Oats.

	l.	s.	d.
To plowing once	0	10	4
To ſeed oats, 2 barrels	0	12	0
To harrowing, 4 s. 6 d. ſeed-man 4 d.	0	4	10
To one year's rent	0	18	0
	2	5	2

Theſe two crops conſume three years; after which the farmer is to begin again, and to incur every article of expence ſtated in the above accounts, in order to obtain two crops more.

An Eſtimate of Expence upon a Plantation Acre of Wheat in the Drill Huſbandry, the firſt Year.

	l.	s.	d.
To plowing 4 times, to prepare the fallow [This is the ſame charge as in preparing for the common huſbandry.]	2	1	4
To harrowing twice for ditto [This is the ſame alſo.]	0	9	0
To rent for the year of fallow [This charge is ſaved after the firſt year.]	0	18	0
To harrowing with the drill harrows [Four acres a day may be harrowed with one horſe.]	0	0	6½
To ſowing with the drill plow [From 3 to 5 acres may be ſown in a day.]	0	1	1
To ſeed-wheat, generally 5 ſtone, but ſuppoſe 6	0	6	0
To the firſt, or winter hoeing [Two acres may be hoed in a day, two horſes, plow-man and driver: the deſign of this hoeing is to leave the plants dry, and to meliorate the earth.]	0	1	7
To the ſpring hoeing with the cultivator [To deepen the ſoil, one horſe, plow-man and driver.]	0	1	1
To the 3d hoeing, i. e. to return the meliorated earth to the corn [To make the corn tiller, i. e. to encreaſe its branches.]	0	1	7
To the fourth and final hoeing [To fill the grain and render it large.]	0	1	1
To rent, the year the corn is growing	0	18	0
	4	19	3½

N. B. Although the drill culture for the firſt year is very near as expenſive as the common, yet, after taking the firſt crop, the expence and labour of fallow, and loſs of time, is not to be incurred again, as is unavoidable in the common huſbandry.

An Eſtimate of Expence upon an Acre of drilled Wheat, after the firſt Crop.

	l.	s.	d.
To plowing the land once [One plowing is all that is neceſſary.]	0	10	4
To harrowing with the drill harrow	0	0	6½
To ſowing with the drill plow	0	1	1
To ſeed-wheat [Be it remembered, 5 ſtone is enough.]	0	6	0
	0	17	11½
To four times horſe-hoeing, as before ſtated	0	5	4
To one year's rent	0	18	0
	2	1	3½

Thus the land is ſown again with wheat every year, and inſtead of 4 l. 9 s. which is the farmer's expence in the common huſbandry, excluſive of one year's rent of the land; in the drill method it is no more than 17 s. 11½ d. and the total expence, inſtead of 5 l. 7 s. is no more than 2 l. 1 s. 3½ d. rent included; whereby there is a ſaving of 3 l. 5 s. 8½ d. an acre.

Before the account of profit and loſs upon theſe different methods of culture be ſtated, it will be neceſſary to take notice of an objection, which may perhaps be made to the above charge of plowing in the common huſbandry. It is pretended, that three quarters of an acre may be plowed in a day, with one plow: but can it be done effectually? The land may, indeed, be ſcratched, but cannot really be plowed as it ought to be. The farmer ought to be cautioned againſt a trick too frequently practiſed in plowing. When a plow-man enters his plow, and paſſes acroſs the field, he turns a ſod about a foot broad; when he is to return, he enters his plow about fout feet diſtant from the out-ſide of the former furrow, and ſo turns another ſod of the ſame breadth, which, when turned, juſt meets the former ſod;

ſod; thus four feet of the land appear to be plowed, whereas the fact is, that the two feet lying under the ſods is not touched with the plow at all. This deception, added to the practice of juſt ſkimming the ground, enables hirelings to undertake plowing at 6 and 7 s. an acre. But if a plantation acre of land be well and effectually plowed, 10 s. 4 d. as charged above, will not appear too much; and it is, in fact, ſupported by the common courſe of buſineſs.

When wheat is to be ſown, it is the general cuſtom to ſend a barrel of ſeed into the field with two plows, which is to ſow an acre of land, and that is the uſual day's work for two plows in the general courſe of buſineſs. Let us ſee then what the expence will amount to. Eight cattle will be 8 s. two plow-men 1 s. 4 d. two drivers 1 s. and the ſeeds-man 8 d. which in all makes 11 s. and correſponds with the above charge.

Dr. One Acre of Wheat and Oats in the common Huſbandry, for fifteen Years. *Per Contra*, Cr.

	l.	s.	d.
To the expence on a wheat crop, 2d year —	5	7	0
——— an oat crop, 3d ———	2	5	2
——— a wheat crop, 5th ———	5	7	0
——— an oat crop, 6th ———	2	5	2
——— a wheat crop, 8th ———	5	7	0
——— an oat crop, 9th ———	2	5	2
——— a wheat crop, 11th ——	5	7	0
——— an oat crop, 12th ——	2	5	2
——— a wheat crop, 14th ——	5	7	0
——— an oat crop, 15th ——	2	7	2
	38	0	10
To clear profit in 15 years ———————	27	19	2
	66	0	0

	l.	s.	d.
By the produce of wheat 9 barrels, at 20 s. —	9	0	0
——— oats, — 14 ——— 6 s. —	4	4	0
——— wheat, 9 ——— 20 s. —	9	0	0
——— oats, — 14 ——— 6 s. —	4	4	0
——— wheat, 9 ——— 20 s. —	9	0	0
——— oats, — 14 ——— 6 s. —	4	4	0
——— wheat, 9 ——— 20 s. —	9	0	0
——— oats, — 14 ——— 6 s. —	4	4	0
——— wheat, 9 ——— 20 s. —	9	0	0
——— oats, — 14 ——— 6 s. —	4	4	0
	66	0	0

Dr. One Acre of drilled wheat, for fifteen years. *Per Contra*, Cr.

	l.	s.	d.
To the firſt and 2d years expence ———	4	19	3½
——— 3d ———	2	1	3½
——— 4th ———	2	1	3½
——— 5th ———	2	1	3½
——— 6th ———	2	1	3½
——— 7th ———	2	1	3½
——— 8th ———	2	1	3½
——— 9th ———	2	1	3½
——— 10th ———	2	1	3½
——— 11th ———	2	1	3½
——— 12th ———	2	1	3½
——— 13th ———	2	1	3½
——— 14th ———	2	1	3½
——— 15th ———	2	1	3½
	31	16	1
To clear profit in fifteen years ———	52	3	11
	84	0	0

	l.	s.	d.
By the produce of wheat, 2d year, 6 barrels	6	0	0
——— 3d ———	6	0	0
——— 4th ———	6	0	0
——— 5th ———	6	0	0
——— 6th ———	6	0	0
——— 7th ———	6	0	0
——— 8th ———	6	0	0
——— 9th ———	6	0	0
——— 10th ———	6	0	0
——— 11th ———	6	0	0
——— 12th ———	6	0	0
——— 13th ———	6	0	0
——— 14th ———	6	0	0
——— 15th ———	6	0	0
	84	0	0

	l.	s.	d.
To clear profit ariſing upon an acre of land in fifteen years in the drill huſbandry —	52	3	11
To clear profit ariſing upon an acre of land in fifteen years in the common huſbandry	27	19	2
Greater profit on the drilled acre, in fifteen years ———	24	4	9

Which amounts to 1l. 12 s. 3¼ d. per annum, for fifteen years on the acre, more than by the common huſbandry.

In the drill huſbandry the crops are ſtated at three barrels of wheat leſs upon an acre than in the common huſbandry, that it may not be ſuppoſed to be over-rated; but in the common huſbandry, the crops are rated at the higheſt; fourteen barrels of oats an acre, are alſo allowed in the common huſbandry, which every farmer muſt admit to be a great allowance upon the general produce.

Doubtleſs, it will be obſerved, that in fifteen years fourteen wheat crops are obtained in the drill huſbandry; in the common huſbandry only five wheat and five oat crops; the five other years are not only loſt, but are an heavy expence to the farmer.

A farmer having forty acres of tillage, ſuppoſing him to direct his attention to bringing it to the drill culture, would make in fifteen years 969 l. 10 s. more than he can in the common huſbandry; which is ſuch an advantage, that the greater profit in the drilled acre in fifteen years will purchaſe the fee-ſimple of that in the common huſbandry, at twenty ſeven years purchaſe, valuing the land at 18 s. an acre.

Thus it appears, that in every fifteen years the fee-ſimple of all the tillage land of the kingdom, is loſt to the community by the common courſe of tillage.

In ſtating theſe accounts, no mention is made of fences, water, cutting the land, weeding and reaping, as theſe articles of expence depend on a variety of circumſtances, but, in general, will be more on the common huſbandry than on the drill.

WHEEL, *Rota*, in mechanics, a ſimple machine, conſiſting of a round piece of wood, metal, &c. which revolves on an axis.

WHEEL-*Carriages*. The whole doctrine of wheel-carriages (as it is founded on a mathematical theory) may be reduced to the following particulars, viz. (1.) wheel-carriages meet with leſs reſiſtance than any other. (2.) The larger the wheels, the eaſier the draught of the carriage. (3.) A carriage upon four large wheels, of equal ſize, is drawn with leſs force than with two of thoſe wheels and two of a leſſer ſize. (4.) If the load be laid on the axle of the larger wheels, it will be drawn with leſs force than if laid on the axis of the leſſer wheels, contrary to the common notion of loading carriages before. (5.) The carriage goes with much leſs force on friction-wheels, than in the common way.

WHEEL is alſo the name of a kind of puniſhment which great criminals are put to in divers countries. In France, their aſſaſſins, parricides, and robbers on the highway, are condemned to the wheel; i. e. to have their bones

firſt broken with an iron bar on a ſcaffold, and thus to be expoſed and left to expire on the circumference of a wheel. In Germany they break their bones on the wheel itſelf.

WHEEL, in the military art, is the word of command, when a battalion or ſquadron is to alter its front either one way or the other. To wheel to the right, directs the man in the right angle to turn very ſlowly, and every one to wheel from the left to the right, regarding him as their center; and *vice verſa*, when they are to wheel to the left. When a diviſion of men are on the march, if the word be to wheel to the right or to the left, then the right or left hand man keeps his ground; only turning on his heel, and the reſt of the rank move about quick till they make an even line with the ſaid right or left hand man.

WHEEL-ANIMALS, *Brachionus*, a genus of animalcules which have an apparatus of arms for taking their prey. This apparatus has been ſuppoſed by microſcopical writers, to be a kind of wheels, and thence named the creatures that are poſſeſſed of it wheel-animals.

This is one of the ſmaller animalcules; and is, by Dr. Hill, deſcribed to be, when in a ſtate of reſt, of a plane ſmooth body, of a conic figure, obtuſe at the poſterior extremity, and open at the anterior, of a duſky olive colour, and ſemi-tranſparent. When it puts itſelf in motion, it protrudes, from the open extremity, a part of its naked body; to the whole of which this outer-conic body ſeems to be but a caſe or ſheath; from the extremity of this exerted part of the body, the creature ſoon after thruſts out two protuberances, which give it the appearance of a double head; and in each of theſe is diſcovered an apparatus in a continual motion, appearing a rotatory one, but in reality a vibratory one very quick repeated. Each of theſe protruded bodies has ſix arms inſerted into it, and theſe it continually ſhuts and opens over one another. Each of theſe arms is furniſhed with double ſeries of fibres at its edge, which being expanded cauſe it to ſpread to a conſiderable breadth. There are ſeveral ſpecies of this genus of animalcules.

WHEEZING, a name given by our farriers to a diſtemperature in horſes, in which they draw their breath with difficulty and noiſe.

The generality of people make this and purſineſs in horſes the ſame diſtemper; but the more judicious always diſtinguiſh it, as wholly different from that. Purſineſs proceeds always from a ſtuffing or oppreſſion of the lungs; but this wheezing is only owing to the narrowneſs of the paſſages between the bones and griſtles of the noſe.

The horſes that are moſt of all afflicted with this diſtemper, do not want wind; for notwithſtanding they wheeze exceſſively when they are exerciſed, yet all the time their flanks are not moved, but keep in the ſame condition that they were while the creature ſtood ſtill. The dealers call theſe ſort of horſes blowers, and though there is no real harm in the thing, it is a diſagreeable quality, and few people will chuſe them that have much ſervice for them.

There are ſome horſes that have a natural defect in their breathing, which makes it at all times attended with ſome difficulty, but not with the wheezing before-mentioned; theſe are called thick-winded horſes.

People who are careful in the buying horſes, will purchaſe neither of theſe kinds; but then is this caution to be obſerved in regard to this defect, that it often ſeems to be in horſes where it really is not. When a horſe has been kept a long time in the ſtable without exerciſe, he will, at the firſt riding, be out of breath, and fetch it in a difficult and painful manner, though he be neither a blower or thick-winded; but all this will go off with a little exerciſe.

There are ſome temporary wheezers and blowers among horſes: theſe, at times, rattle, and make a great noiſe through their noſes in taking breath; but the complaint goes off and returns. This is only occaſioned by a great quantity of phlegm, for their flanks do not redouble with it at the worſt of times, nor have they any cough with it; ſo that there is no danger of their being purſy.

WHELP, the young of a dog, fox, lion, or any wild beaſt. Nothing is more eſſential to the having a good pack of hounds, than a proper care of the whelps, and of the parents from which they are to be bred. The bitches in particular ſhould be carefully choſen, and ſhould be ſuch as are ſtrong and well proportioned; they muſt alſo have large ribs and flanks.

The whelps muſt have good freſh ſtraw to lie in, and it muſt be often changed; they are to be kept in a place where neither the rain nor ſunſhine can be troubleſome to them, and once a week it will be proper to anoint them all over with a little nut-oil, with ſome ſaffron infuſed in it. This will prevent the flies from annoying them ſo much as they otherwiſe would, and will kill worms of all kinds. When they are fifteen days old it is the cuſtom to worm them, and a week after, one joint of their ſtern ſhould be twiſted off. As ſoon as they can ſee, they ſhould have milk given them to lap; and at two months old, they ſhould be weaned, keeping them wholly from the bitch. They muſt at this time be well kept, but not too high fed; and it is proper to put ſome cummin ſeed into their food, to keep the wind out of their bellies.

WHELPS, in a ſhip, the ſeaman's term for thoſe brackets which are ſet up on the capſtan cloſe under the bars; they give the ſweep to it, and are ſo contrived, that the cable winding about them may not ſurge ſo much as it might otherwiſe do, if the body of the capſtan were quite round and ſmooth.

WHETSTONE, *Cos*, a ſtone which ſerves for the whetting of knives and other tools upon.

WHEY, the ſerum, or watery part of milk.

WHIFFLER of a company, in London, a young freeman who goes before, and waits on the company on ſolemn aſſemblies.

WHIG, a party in England oppoſite to the tories, from whom they differ chiefly in their political principles. See TORIES.

The names of whig and tory were not known till about the middle of the reign of Charles II. when theſe were given as party diſtinctions. Theſe parties may be conſidered either with regard to the ſtate, or to religion. The ſtate tories are either violent or moderate: the firſt would have the king to be abſolute, and therefore plead for paſſive obedience, non-reſiſtance, and the hereditary right of the houſe of Stuart. The moderate tories would not ſuffer the king to loſe any of his prerogative; but then they would not ſacrifice thoſe of the people. The ſtate whigs are either ſtrong republicans or moderate ones. The firſt, ſays Rapin, are the remains of the party of the long parliament, who attempted to change the monarchy to a commonwealth: but theſe make ſo ſlender a figure, that they only ſerve to ſtrengthen the party of the other whigs. The tories would perſuade the world, that all the whigs are of this kind; as the whigs would make us believe that all the tories are violent. The moderate ſtate whigs are much in the ſame ſentiments with the moderate tories, and deſire that the government may be maintained on the ancient foundation: all the difference is, that the firſt bear a little more to the parliament and people, and the latter to that of the king. In ſhort, the old whigs were always jealous of the incroachments of the royal perogative, and watchful over the preſervation of the liberties and properties of the people.

In regard to religion, the whigs have always been for limiting the power of the biſhops, and aboliſhing the convocation.

WHIP, or WHIP-STAFF, in a ſhip, a piece of timber, in form of a ſtrong ſtaff, faſtened into the helm, for the ſteerſman, in ſmall ſhips, to hold in his hand, in order to move the rudder and direct the ſhip.

WHIRL-POOL, an eddy, vortex, or gulph, where the water is continually turning round. In rivers theſe are very common, from various accidents, and are uſually very trivial, and of little conſequence: In the ſea they are more rare, but more dangerous.

Sibbald has related the effects of a very remarkable marine whirl-pool among the Orcades, which would prove very dangerous to ſtrangers, though it is of no conſequence to the people who are uſed to it. This is

not fixed to any particular place, but appears in various parts of the limits of the ſea among thoſe iſlands. Wherever it appears it is very furious; and boats, &c. would inevitably be drawn in and periſh with it; but the people who navigate them are prepared for it, and always carry an empty veſſel, a log of wood, or large bundle of ſtraw or ſome ſuch thing, in the boat with them: as ſoon as they perceive the whirl-pool, they toſs this within its vortex, keeping themſelves out. This ſubſtance, whatever it be, is immediately received into the center and carried under water; and as ſoon as this is done, the ſurface of the place where the whirl-pool was becomes ſmooth, and they row over it with ſafety; and in about an hour they ſee the vortex begin again in ſome other place, uſually at about a mile diſtant from the firſt. See the articles EDDY and VORTEX.

WHIRL-WIND, a wind that riſes ſuddenly, exceeding rapid and impetuous, when riſen, but ſoon ſpent.

There are divers ſorts of whirl-winds, diſtinguiſhed by their peculiar names; as the preſter, typho, turbo, exhydria, and ecnephias.

The preſter is a violent wind, breaking forth with flaſhes of lightning. This is rarely obſerved; ſcarce ever without the ecnephias. Seneca ſays, it is a typho or turbo kindled or ignited in the air.

The ecnephias is a ſudden and impetuous wind, breaking out of ſome cloud, frequent in the Ethiopic ſea, particularly about the Cape of Good-Hope. The ſeamen call them travados.

The exhydria is a wind burſting out of a cloud with a great quantity of water. This only ſeems to differ in degree from the ecnephias, which is frequently attended with ſhowers.

A typho, or vortex, moſt properly called whirl-wind, or hurricane, is an impetuous wind, turning rapidly every way, and ſweeping all round the place. It uſually deſcends from on high. It is frequent in the Eaſtern-ocean, chiefly about Siam, China, &c. and renders the navigation of thoſe parts exceeding dangerous.

WHISPERING PLACES depend upon this principle: if the vibrations of the tremulous body are propagated through a long tube, they will be continually reverberated from the ſides of the tube into its axis, and by that means prevented from ſpreading, till they get out of it; whereby they will be exceedingly increaſed, and the ſound rendered much louder than it otherwiſe would be.

Hence it is, that ſound is conveyed from one ſide of a whiſpering-gallery to the oppoſite one, without being perceived by thoſe who ſtand in the middle.

The form of a whiſpering-gallery is that of a ſegment of a ſphere, or the like arched figure; and the progreſs of a ſound through it may be illuſtrated in the following manner:

Let A B C (plate CXL. *fig.* 3.) repreſent the ſegment of a ſphere; and ſuppoſe a low voice uttered at D, the vibrations expanding themſelves every way, ſome will impinge upon the points E, E, &c. and from thence be reflected to the point F, from thence to G, and ſo on till they all meet in C, and by their union there, cauſe a much ſtronger ſound than in any part of the ſegment whatever, even at D, the point from whence they came. Accordingly, all the contrivance in whiſpering places is, that near the perſon that whiſpers there may be a ſmooth wall, arched either cylindrically or elliptically. A circular arch will do, but not ſo well.

The moſt conſiderable whiſpering places in England are, the whiſpering-gallery in the dome of St. Paul's, London, where the ticking of a watch may be heard from ſide to ſide, and a very eaſy whiſper be ſent all round the dome. The famous whiſpering place in Glouceſter cathedral, is no other than a gallery above the eaſt end of the choir, leading from one ſide thereof to the other. It conſiſts of five angles and ſix ſides, the middlemoſt of which is a naked window, yet two whiſperers hear each other at the diſtance of twenty-five yards.

WHITE, one of the colours of natural bodies. See COLOUR.

White is not ſo properly ſaid to be any one colour, as a compoſition of all colours; for it is demonſtrated by Sir Iſaac Newton, that thoſe bodies only appear white, which reflect all the kinds of coloured rays alike.

WHITE, in painting in miniature, &c. The beſt white for painting in water-colours, is flake white, which is better than white lead; and if it be pure, far exceeds it in beauty; becauſe white lead is apt to turn blackiſh, eſpecially if it be uſed in a hard water: but if you uſe white lead, firſt rectify it with white wine vinegar in the following manner: grind well the fineſt white lead upon a porphyry with vinegar; then put it into a glaſs of water, ſtir it about, and preſently pour off the water, while it is white, into ſome other clean glaſs or veſſel; let it ſettle, and then pour off the water from it, and it will be exceeding fine. When this white is ſettled, put to it gum-water, to bind it and give it a glaze.

Some recommend a white made of the whiter part of oyſter-ſhells, reduced into an impalpable powder; this is called pearl white, and will mix with any colour. Some alſo recommend the powder of egg-ſhells of the brighteſt colour, and well cleaned and waſhed, ground with gum-water, to which may be added about a twentieth part of white ſugar-candy: the egg-ſhells ſhould be ground to an impalpable powder. Experience proves, that egg-ſhell powder is of very great ſervice as a white in water-colours, and both that and the powder of oyſter-ſhells, well rectified and mixed with the white of an egg well beaten, will make an extraordinary mixture in other colours, and will correct them from changing or altering their qualities.

WHITE *of the Eye*, denotes the firſt tunic or coat of the eye, called albuginea and conjunctiva, becauſe it ſerves to bind together, or incloſe, the reſt. See the article EYE.

WHITE-FRIARS, a name common to ſeveral orders of monks, from their being clothed in a white habit.

WHITE-HART *Silver*, a mulct or tribute paid into the Exchequer, out of certain lands in or near the foreſt of White-hart in Dorſetſhire; impoſed by Henry III. upon Thomas de la Linde, for killing a beautiful white hart which that prince had before ſpared in hunting.

WHITE-HORSE, in ichthyology, the prickly backed raia, with two ſeries of prickles on the tail, and one ſeries over each eye.

This is a ſingular ſpecies, the body is conſiderably broad in proportion to its length, but it is alſo thick; the back is ſomewhat gibboſe, but the belly is more flat; the roſtrum is oblong and acute, the eyes are prominent, and there is an aperture behind each; the mouth is tranſverſe and large, and furniſhed with a number of ſharp teeth; the apertures of the gills run down from it on each ſide along the breaſt; they are ſmall, and there are five of them on each ſide.

WHITE-LEAD, alſo called ceruſe. See the article CERUSE.

WHITE-LINE, among printers, a void ſpace of the depth or breadth of a line. See the article PRINTING.

WHITE-MEATS, include milk, butter, cheeſe, white-pots, cuſtards, and other kinds of food made of milk or eggs. Some alſo add chickens, veal, and fiſh.

WHITE-POT, milk or cream beat up with the yolks of eggs, mixed with ſugar and ſpice, and baked in an earthen diſh, with ſlices of bread in it.

The cooks furniſh us with a variety of diſhes under this denomination; as the rice white-pot, Weſtminſter white-pot, Norfolk white-pot, &c.

WHITE-RENT, a rent or duty of 8 d. paid annually by every tinner in the county of Devon, to the duke of Cornwall.

WHITE SEA, in geography, a bay of the Frozen ocean, in the north of Muſcovy, between Ruſſian Lapland and Samoieda.

Spaniſh-WHITE, a kind of fucus uſed by ladies to heighten the complexion, and hide its defects.

It is made of tin-glaſs diſſolved in ſpirit of nitre, and precipitated into a very fine powder by means of ſalt-water. See TIN.

WHITE-WINE, wine of a bright tranſparent colour, bordering on white, thus called to diſtinguiſh it from the red wines. See WINE.

WHITE-

The generality of white-wines are made from white grapes; though there are ſome from black ones, only the ſkins are kept from tinging them.

WHITENESS, *Albugo*, the quality which denominates a body white. See the articles WHITE and COLOUR.

Sir Iſaac Newton ſhews, that whiteneſs conſiſts in a mixture of all the colours; and that the light of the ſun is only white, becauſe conſiſting of rays of all colours. See RAY.

From the multitude of rings of colours which appear upon compreſſing two priſms or object-glaſſes of teleſcopes together, it is manifeſt that theſe do ſo interfere and mingle with one another at laſt, as, after eight or nine reflections, to dilute one another wholly, and conſtitute an even and uniform whiteneſs; whence, as well as from other experiments, it appears, that whiteneſs is certainly a mixture of all colours, and that the light which conveys it to the eye, is a mixture of rays endued with all thoſe colours. See LIGHT.

The ſame author ſhews, that whiteneſs, if it be moſt ſtrong and luminous, is to be reckoned of the firſt order of colours; but if leſs, as a mixture of the colours of ſeveral orders. Of the former ſort he reckons white metals, and of the latter, the whiteneſs of froth, paper, linnen, and moſt other white ſubſtances. And as the white of the firſt order is the ſtrongeſt that can be made by plates of tranſparent ſubſtances, ſo it ought to be ſtronger in the denſer ſubſtances of metals than in the rarer ones of air, water, and glaſs. Gold or copper mixed either by fuſion, or amalgamation with a very little mercury, with ſilver, tin, or regulus of antimony, becomes white, which ſhews both that the particles of white metals have much more ſurface, and therefore are ſmaller than thoſe of gold and copper; and alſo that they are ſo opake, as not to ſuffer the particles of gold or copper to ſhine through them. And as that author doubts not but that the colours of gold and copper are of the ſecond and third order, therefore the particles of white metals cannot be much bigger than is requiſite to make them reflect the white of the firſt order.

WHITING, in ichthyology, the Engliſh name for the white gadus with no beard, and with three fins on the back, and the under jaw longeſt.

The head and body of this ſpecies is compreſſed, the back is convex, the anus is at a great diſtance from the tail, and is, indeed, very near the head; the colour of the whole fiſh is a ſilvery white, except that on the back there is an admixture of a blackiſh tinge; the ſcales are very ſmall, roundiſh and white; the noſtrils have each a double aperture, and are placed high; the eyes are very large, the iris ſilvery, and the pupil large and blue; the teeth are very numerous; the pectoral fins have each ſix rays; the pinnæ ani are two, and have, the firſt thirty-three, and the ſecond twenty-two rays. This ſpecies is frequent in our ſeas, and much eſteemed at our tables.

WHITES, in medicine, the ſame with fluor albus. See FLUOR ALBUS.

WHITLOW, in medicine. See the article PARONYCHIA.

WHITSUNDAY, a ſolemn feſtival of the chriſtian church, obſerved on the fiftieth day after Eaſter, in memory of the deſcent of the Holy Ghoſt upon the apoſtles in the viſible appearance of fiery cloven tongues, and of thoſe miraculous powers which were then conferred upon them.

It is called Whitſunday, or White-ſunday, becauſe this being one of the ſtated times for baptiſm in the ancient church, thoſe who were baptiſed put on white garments, as types of that ſpiritual purity they received in baptiſm. As the deſcent of the Holy Ghoſt upon the apoſtles happened upon the day which the Jews called Pentecoſt, this feſtival retained the name of Pentecoſt among the Chriſtians.

WHOODINGS, or HOODINGS, a ſea term, uſed for planks joined and faſtened along the ſhip's ſide into the ſtem.

WHORE, a woman who proſtitutes herſelf for hire.

WHORLBAT or HURLBAT, a kind of gauntlet, or leathern ſtrap, loaden with plummets; uſed by the ancient Romans in their ſolemn games and exerciſes, and by them called cæſtus.

WIC, a place on the ſea-ſhore, or on the bank of a river: though it properly ſignifies a town, village, or dwelling-place; and ſometimes a machine.

WICKER, a twig of the oſier ſhrub, ſingle or wrought.

WICKET, a ſmall door in the gate of a fortified place, &c. or a hole in a door, through which to view what paſſes without.

WICKLIFFISTS, or WICKLIFFITES, a religious ſect, who had their riſe in England, and their name from their leader John Wickliff, a profeſſor of divinity in the univerſity of Oxford.

To that immortal author it is we owe the firſt hint of the great Reformation, effected 200 years after him.

Wickliff maintained, that the ſubſtance of the ſacramental bread and wine ſtill remained ſuch after conſecration. He alſo oppoſed the doctrine of purgatory, indulgences, the invocation of ſaints, and the worſhip of images.

He made an Engliſh verſion of the Bible; and compoſed two large volumes, called Aletheia; that is, Truth; which was the ſource whence John Huſs firſt learned moſt of his doctrines.

The archbiſhop of Canterbury called a council againſt Wickliff, and he was condemned therein; but the good reformer ſet the condemnation at nought. After this, king Richard baniſhed him out of England; but he was afterwards recalled, and died in his own country in the year 1384.

Forty years afterwards, his doctrines, and the adherents thereto, were condemned by the council of Conſtance; in conſequence of which, his bones were dug up, and the council condemned him for forty errors.

WIDOW, a woman who has loſt her huſband.

In London, a freeman's widow may exerciſe her huſband's trade, as long as ſhe continues ſuch.

Marriage with a widow, in the eye of the canon law, is a kind of bigamy.

WIDOW *of the king*, was ſhe who after her huſband's death, being the king's tenant in capite, could not marry again without the king's conſent.

WIFE, a married woman, or one joined with, and under the protection of, an huſband.

A wife, in our Engliſh law, is termed feme covert; and in the judgment of the law is reputed to have no will, as being ſuppoſed intirely under, and ſubject to, that of her huſband.

The wife can make no contract without the huſband's conſent; and if any goods or chattels be given her, they all immediately become her huſband's: even neceſſary apparel is not her's in property.

All her perſonal chattels, which ſhe held at her marriage, are ſo much her huſband's, that after his death they ſhall not return to her, but go to the executor or adminiſtrator of her huſband, except only her paraphernalia.

The wife partakes of the honour and condition of her huſband; but none of her dignities come by marriage to her huſband; and as the law ſuppoſes the huſband to have the full power over his wife, he is obliged to anſwer for all her faults and treſpaſſes. If a wife bring forth a child begot by a former huſband or any other, before marriage, but born after marriage with another man; this latter muſt own the child; and that child ſhall be his heir at law; and if a wife bring forth a child during her huſband's abſence, though it be of many years; yet if he lived all the time within the iſland he muſt father the child, and the child if firſt-born, ſhall inherit. If the wife has a jointure, and during her marriage is made pregnant by her huſband, which muſt appear by the child's being born alive, the huſband ſhall have all his wife's lands for life; but if the wife have no jointure ſettled before marriage, ſhe may, after her huſband's death, challenge the third part of his yearly rents of land, during her life.

WILDERNESS, in gardening, a kind of grove of large trees, in a ſpacious garden, in which the walks are commonly made either to interſect each other in angles,

or have the appearance of meanders and labyrinths. See GROVE and LABYRINTH.

Wilderneſſes, ſays Mr. Miller, ſhould always be proportioned to the extent of the gardens in which they are made; for it is very ridiculous to ſee a large wilderneſs planted with tall trees in a ſmall ſpot of ground; and, on the other hand, nothing can be more abſurd than to ſee little paltry ſquares, or quarters of wilderneſs-work, in a magnificent large garden. As to the ſituation of wilderneſſes, they ſhould never be placed too near the habitation, nor ſo as to obſtruct any diſtant proſpect of the country; there being nothing ſo agreeable as an unconfined proſpect; but where, from the ſituation of the place, the ſight is confined within the limits of the garden, nothing can ſo agreeably terminate the proſpect, as a beautiful ſcene of the various kinds of trees judiciouſly planted; and if it is ſo contrived, that the termination is planted circularly, with the concave towards the ſight, it will have a much better effect, than if it end in ſtraight lines or angles. The plants ſhould always be adapted to the ſize of the plantation; for it is very abſurd for tall trees to be planted in the ſmall ſquares of a little garden; and in large deſigns ſmall ſhrubs will have a mean appearance. It ſhould alſo be obſerved, never to plant ever-greens amongſt deciduous trees; but always to place the ever-greens in a wilderneſs in a ſeparate part by themſelves, and that chiefly in ſight.

As to the walks, thoſe that have the appearance of meanders, where the eye cannot diſcover more than twenty or thirty yards in length, are generally preferable to all others, and theſe ſhould now and then lead into an open circular piece of graſs; in the center of which may be placed either an obeliſk, ſtatue, or fountain; and, if in the middle of the wilderneſs there be contrived a large opening, in the center of which may be erected a dome or banquetting-houſe, ſurrounded with a green plot of graſs, it will be a conſiderable addition to the beauty of the whole. From the ſides of the walks and openings, the trees ſhould riſe gradually one above another to the middle of the quarters, where ſhould always be planted the largeſt growing trees, ſo that the heads of all the trees may appear to view, while their ſtems will be hid from the ſight. Thus in thoſe parts which are planted with deciduous trees, roſes, honey-ſuckles, ſpiræa frutex, and other kinds of low-flowering ſhrubs, may be planted next the walks and openings; and at their feet, near the ſides of the walks, may be planted primroſes, violets, daffodils, &c. not in a ſtrait line, but ſo as to appear accidental, as in a natural wood. Behind the firſt row of ſhrubs ſhould be planted ſyringas, althæa frutex, mezereons, and other flowering ſhrubs of a middle growth; and theſe may be backed with many other ſorts of trees, riſing gradually to the middle of the quarters.

The part planted with ever-greens, may be diſpoſed in the following manner, viz. in the firſt line next the great walks, may be placed the lauruſtinus, boxes, ſpurge-laurel, juniper, ſavin, and other dwarf ever-greens. Behind theſe may be placed laurels, hollies, arbutuſes, and other ever-greens of a larger growth. Next to theſe may be planted alaternuſes, phyllireas, yews, cypreſſes, Virginian cedars, and other trees of the ſame growth; behind theſe may be planted Norway and ſilver firs, the true pine, and other ſorts of the fir growth; and in the middle ſhould be planted Scotch pines, pinaſter, and other of the larger growing ever-greens, which will afford a moſt delightful proſpect, if the different ſhades of the greens are curiouſly intermixed.

But beſide the grand walks and openings, which ſhould always be laid with turf, and kept well mowed, there ſhould be ſome ſmaller ſerpentine-walks through the middle of the quarters, where perſons may retire for privacy; and by the ſides of theſe private walks may alſo be ſcattered ſome wood flowers and plants, which, if artfully planted, will have a very good effect.

In the general deſign for theſe wilderneſſes, there ſhou'd not be a ſtudied and ſtiff correſpondency between the ſeveral parts; for the greater diverſity there is in the diſtribution of theſe, the more pleaſure they will afford.

WILL, *Voluntas*, is uſually defined a faculty of the mind, whereby it embraces or rejects any thing repreſented to it, as good or evil, by the judgment.

Others will have it to be the mind itſelf, conſidered as embracing or refuſing; adding, that as the underſtanding is nothing elſe but the ſoul, conſidered as perceiving; ſo the will is nothing elſe but the ſoul conſidered as willing, &c.

Mr. Locke more intelligibly defines the will, a faculty which the ſoul has of beginning or forbearing, continuing or ending ſeveral actions of the mind, and motions of the body, barely by a thought or preference of the mind, ordering, or as it were commanding the doing, or not doing, ſuch and ſuch a particular action. This power the mind has, to order the conſideration of any idea, or the forbearing to conſider it; or to prefer the motion of any part of the body to its reſt, and vice verſa, is what we call the will.

The actual exerciſe of that power, is what we call volition, or willing; and the doing or forbearing any action conſequent on ſuch order of the mind, is called voluntary.

Father Malebranche lays it down, that the will is that to the ſoul, which motion is to the body; and argues, that as the Author of nature is the univerſal cauſe of all the motions in matter, ſo he is of all the inclinations in the mind: and, that as all motions are direct, unleſs their courſe be diverted and changed by ſome foreign cauſe; ſo all inclinations are right, and could have no other end, but the enjoyment of truth and goodneſs, were there not ſome foreign cauſe to determine the natural impreſſion to evil ends.

Accordingly, he defines will to be the impreſſion or natural motion which carries us towards good indeterminately, and in the general; and the power the mind has to direct this general impreſſion towards any particular object that pleaſes it, is what he calls liberty.

Ariſtotle diſtinguiſhes two kinds of acts of the will; viz. βουλησις, willing volition; and προαιρεσις, election. The firſt, that employed about the ultimate end; the latter, about the means.

The ſchoolmen alſo diſtinguiſh the actions of the will into elicit and commanded. Elicit acts are thoſe immediately produced by the will, and really inherent therein, ſuch are willing; and willing-commanded acts are effects produced by other powers; v. gr. the ſenſitive, intellective, or locomotive powers, at the command or inſtigation of the will.—As, to follow, ſtay fight, fly, &c.

But others will have the former kind properly to belong to the underſtanding; and only the latter to the will.

The word will is taken in three ſenſes; 1. For the power, or faculty of willing, in which ſenſe it is we have conſidered it above. 2. For the act, or exerciſe of this power; as when we ſay, No man wills his own deſtruction. 3. For a habit, or a conſtant diſpoſition and inclination to do any thing. In which ſenſe, juſtice is defined a conſtant will, to give every one what belongs to him.

WILL, or *laſt* WILL, in law, ſignifies the declaration of a man's mind and intent relating to the diſpoſition of his lands, goods, or other eſtate, or of what he would have done after his death.

In the common law, there is a diſtinction made between a will and a teſtament; as that is called a will, where lands or tenements are given; and when the diſpoſition concerns goods and chattels alone, it is termed a teſtament. See the article TESTAMENT.

A will, though it has no force till after the teſtator's deceaſe, does then, without any other grant, or livery, &c. give and transfer eſtates, and alter the property either of lands or goods, as effectually as any deed or conveyance executed in a perſon's life-time, and thereby deſcents may be prevented, eſtates in fee, tail, for life, or for years, be made, and he that takes lands by deviſe is in the nature of a purchaſer. Formerly a perſon could not give away by will thoſe lands that he had by deſcent, though he might ſuch as he enjoyed by way of purchaſe; but by 34 and 35 of Hen. VIII. c. 5. all perſons that have a ſole eſtate in fee ſimple of any lands, tenements, &c.

&c. may deviſe the ſame by will at their pleaſure, to whom they think fit; and this extends to perſons ſeiſed in coparcenary, or as tenants in common; but lands intailed are not deviſable, only thoſe held in fee, and goods and chattels: but wills made by infants or feme coverts, idiots, and perſons not of ſound memory, are deemed not good in law. The 29 Car. II. c. 23 has enacted, that all wills and deviſes of lands, &c. ſhall be in writing, ſigned by the deviſor, or ſome other by his expreſs directions, in the preſence of at leaſt three credible witneſſes; and no will made in writing ſhall be revoked, but by another will, or cancelling the ſame by the teſtator himſelf, or by his direction.

In the making of a will there are theſe ſeveral rules to be obſerved, viz. 1. That it be done while the teſtator is of ſound mind and memory. 2. That there be two parts thereof, the one to remain in the hands of the party that made it; and the other in the cuſtody of ſome friend, in order to render it leſs liable to be ſuppreſſed after the teſtator's death. 3. That the whole be written in one hand writing, and, if poſſible, in one ſheet of paper or parchment. 4. In caſe there be more ſheets than one, that the teſtator ſign and ſeal every ſheet, before the witneſſes preſent at the execution.

WILL *with a wiſp*, or *Jack with a lanthorn*, a meteor known among the people under theſe names, but more uſually among authors under that of ignis fatuus. See METEOR.

This meteor is chiefly ſeen in ſummer nights, frequenting meadows, marſhes, and other moiſt places. It ſeems to ariſe from a viſcous exhalation, which being kindled in the air, reflects a ſort of thin flame in the dark, without any ſenſible heat.

It is often found flying along rivers, hedges, &c. by reaſon it there meets with a ſtream of air to direct it. The ignis fatuus, ſays Sir Iſaac Newton, is a vapour ſhining without heat; and there is the ſame difference between this vapour and flame, as between rotten wood ſhining without heat, and burning coals of fire.

WILLOW, *Salix*, in botany. See the article SALIX.

WIND, *Ventus*, in phyſiology, a ſtream of air flowing out of one place, or region, into another. See AIR.

As the air is a fluid, its natural ſtate is that of reſt, which it endeavours always to keep or retrieve by an univerſal equilibrium of all its parts. When, therefore, this natural equilibrium of the atmoſphere happens by any means to be deſtroyed in any part, there neceſſarily follows a motion of all the circumjacent air towards that part to reſtore it; and this motion of the air is what we call wind.

Hence, with reſpect to that place where the equilibrium of the air is diſturbed, we ſee the wind may blow from every point of the compaſs at the ſame time; and thoſe who live northwards of that point, have a north-wind; thoſe who live ſouthwards, a ſouth-wind; and ſo of the reſt: but thoſe who live on the ſpot, where all theſe winds meet and interfere, are oppreſſed with turbulent and boiſterous weather, whirl-winds and hurricanes; with rain, tempeſt, lightning, thunder, &c. For ſulphureous exhalations from the ſouth, torrents of nitre from the north, and aqueous vapours from every part are there confuſedly huddled, and violently blended together, and rarely fail to produce the phænomena above mentioned. See RAIN, LIGHTNING, &c.

Many are the particular cauſes which produce wind by interrupting the equipoiſe of the atmoſphere; but the moſt general cauſes are two, viz. heat, which, by rarifying the air, makes it lighter in ſome places than it is in others; and cold, which, by condenſing it, makes it heavier. Hence it is, that in all parts over the torrid zone, the air being more rarified by a greater quantity of ſolar rays, is much lighter than in any other parts of the atmoſphere, and moſt of all over the equatorial parts of the earth. And ſince the parts at the equator are moſt rarified, which are near the ſun; and thoſe parts are, by the earth's diurnal rotation eaſtward, continually ſhifting to the weſt; it follows, that the parts of the air which lie on the weſt ſide of the point of the greateſt rarefaction, and, by flowing towards it, meet it, have leſs motion than thoſe parts on the eaſt ſide of the ſaid point, which follow it; and therefore the motion of the eaſtern air would prevail againſt that of the weſtern air, and ſo generate a continual eaſt-wind, if this were all the effect of that rarefaction. But we are to conſider, that as all the parts of the atmoſphere are ſo greatly rarified over the equator, and all about the poles greatly condenſed by extreme cold, this heavier air from either pole is conſtantly flowing towards the equator, to reſtore the ballance deſtroyed by the rareſaction and levity of the air over thoſe regions: hence, in this reſpect alone, a conſtant north and ſouth wind would be generated.

We find by experience, that people in general have but an obſcure idea or confuſed notion of the cauſe of this perpetual current of air from eaſt to weſt, or of a conſtant eaſt wind under the equator. Therefore, in order to elucidate this matter, we ſhall explain it by a figure. Let C B A D E (plate CXL. *fig.* 4.) be part of a ſection of the atmoſphere over the equator, C the eaſt, E the weſt, A the point to which the ſun S is vertical, and R the point of greateſt rareſaction, or that where the air is moſt of all heated, and, conſequently, lighteſt. That this point R is on the eaſtern ſide of the point A, is not difficult to be conceived, when what is ſaid under the article TIDE, is well conſidered. And, becauſe the air at R is by ſuppoſition lighter than where it is colder at C and D, it is plain that in order to obtain an equilibrium, which is neceſſary in a fluid body, the air by its greater weight will have a tendency from C and D towards R, and riſe to a height there greater than at C or D, in proportion as its denſity is leſs.

Now this being the caſe, it is evident, the ſun, being always between the points R and D, will be heating the air on that part: and thoſe regions between R and C, having been deſerted by the ſun, will grow cold; conſequently, the air between C and R, as it is colder, will likewiſe be heavier than that between R and D, which is hotter, and ſo will have a greater momentum, or quantity of motion, towards the point R; and ſince this point R is conſtantly moving after the point A weſtward, the motion of the weſtern air towards it, will be in part diminiſhed by that means; and being alſo inferior in quantity to the motion of the eaſtern air, the latter will prevail over it, and be conſtantly following the ſaid point R from eaſt to weſt, and thus produce a continual eaſt wind.

It may, perhaps, be here ſaid, that though the motion of the air be leſs from *D* to *R*, yet it is ſomething, and ſo there ought to be a weſtern wind, at leaſt in ſome degree, and to ſome diſtance weſtward of the point R. To which we anſwer, that the nature of a fluid will not permit two contrary motions to reſtore or ſuſtain an equilibrium, we mean in regard of the whole body of it; for wherever one part of the fluid is determined to move, all the reſt muſt neceſſarily follow it; otherwiſe the equilibrium of the air would be deſtroyed in one part to make it good in another, a defect which nature cannot be guilty of. Thus, we ſee the tides of the ocean always follow the courſe of the moon from eaſt to weſt, without any motion of the waters from the weſt towards the moon, in the open oceans; and the point R can only be conſidered as the aerial tide, or flood of high air; and has nearly the ſame phænomena with aqueous tides. See TIDES.

This being clearly underſtood, all the reſt is eaſy; for no one can find it difficult to conceive how the cold air from each pole muſt neceſſarily ſet in towards the equator directly, where meeting and interfering with the eaſtern current, it does with that compound a new direction for the moving air which lies between both the former, viz. a north-eaſt current on the north ſide, and a ſouth-eaſt on the ſouth ſide: all which naturally reſults from the doctrine of the compoſition of oblique forces.

For the method of eſtimating the velocity of the wind, ſee the article ANEMOMETER.

Cardinal WINDS, are thoſe which blow from the eaſt, weſt, north, and ſouth, which are called cardinal points.

Collateral WINDS, are thoſe which blow between the cardinal points. The number of theſe is infinite, as the number of points they blow from are; a few of them

only are conſidered in practice, and theſe have names compounded of the cardinal points between which they blow. See the article COMPASS.

WIND, in the manege. A horſe that carries in the wind, is one that toſſes his noſe as high as his ears, and does not carry handſomely. The difference between carrying in the wind, and beating upon the hand, is, that the horſe who beats upon the hand, ſhakes his head, and reſiſts the bridle; but he who carries in the wind, puts up his head without ſhaking, and only ſometimes beats upon the hand. The oppoſite to carrying the wind, is arming and carrying low.

WIND-FLOWER, *Anemone*, in botany. See the article ANEMONE.

WIND-GALL, a name given by our farriers to a diſtemperature of horſes. In this caſe there are bladders full of a corrupt jelly, which, when let out, is thick, and of the colour of the yolk of an egg. They vary in ſize, but are more uſually ſmall than large. Their place is about the fetloc joint, and they grow indifferently on all four legs, and are often ſo painful, eſpecially in the ſummer ſeaſon, when the weather is hot, and the ground dry and hard, that they make the creature frequently ſtumble, or even fall down. The general method of cure is to open the ſwelling, about the length of a bean, and to preſs out the jelly: when this is done, they apply a mixture of the oil of bays, and the white of an egg, covering it with tow. Another method is, after the jelly is all ſqueezed out, to wrap round the part a wet woollen-cloth, and then applying a taylor's hot iron, this is to be rubbed over till the moiſture is carried away; it is then to be daubed all over with pitch, maſtich, and reſin, boiled together, laying tow in plenty over all. The wind-galls that are ſituated near the ſinews, are much the moſt painful of all, and ſooneſt make the horſe lame.

The general cauſe of wind-galls is ſuppoſed to be extreme work or exerciſe in hot weather; but it is to be obſerved, that thoſe horſes which have long joints, will be wind-galled if they work never ſo little. The worſt wind-galls are thoſe of the hinder legs; all the abovementioned methods will frequently miſs of ſucceſs in theſe, and nothing but fire will cure them.

WIND-HATCH, in mining, a term uſed to expreſs the place at which the ore is taken out of the mines.

WIND-MILL, a mill which receives its motion from the impulſe of the wind.

The internal parts of a wind-mill are the ſame with thoſe of a water-will nearly, of which we ſhall take no farther notice, but ſhall confine ourſelves to the theory of the ſails in regard of their poſition, motion, and figure.

In regard of the poſition of the ſails, we muſt conſider that if they are placed direct to the wind, or at right angles to the axis of the mill, they will receive the whole force of the wind, which in this caſe will tend to blow them forward, and conſequently to blow down the mill; which poſition of courſe cannot be admitted.

If the ſails are ſet right to the wind, or parallel with the axis of the mill, it is plain that in that poſition the wind cannot act upon them at all, and therefore they cannot be turned round, nor the mill put into motion; which poſition of the ſail muſt likewiſe be rejected.

Since neither the direct nor right poſition of the ſails will do, an oblique poſition muſt, as there can be no other. Now to ſhew that an oblique poſition of the ſails will turn the mill, let AB (plate CXL. *fig.* 5.) be the axis, CD a ſail, and its angle of obliquity (viz. that which it makes with the axis) be ECG; then if GC be the force of the wind in the direct poſition of the ſail, GE will be the force of the wind in its oblique poſition (as being the ſine of the angle of incidence GCE.) But the force GE is reſolvable into two others, EF and GF; of which the latter, being parallel to the axis, avails nothing in turning the ſail about it; but the other, EF, being perpendicular thereto, is wholly ſpent in compelling the ſail to turn round: which was the thing to be ſhewn.

The force of the wind on the ſail will be as the ſquare of the ſine of incidence, or as $\overline{GE}^2$; for the force of each ſingle particle of air will be as the ſine GE (*fig.* 6.) and it will be alſo as the number of particles which ſtrike it at the ſame time, which number of particles is alſo as the ſine of incidence GE. For let CD repreſent the ſection of the ſail in a direct poſition, and CG the ſame in an oblique poſition, it is plain the number of particles ſtriking it in the former caſe will be to the number ſtriking it in the latter as CD to CF, which is equal to GE the ſine of incidence; for all the particles between AD and BF will not come upon the ſail in the oblique poſition CG. Since then the force of the wind on the ſail is on two accounts as GE, it will be as the ſquare of the ſaid line GE. If we ſuppoſe the velocity of the wind to vary, the force thereof will be as the ſquare of the velocity; for the greater the velocity, the greater will be the ſtroke of each ſingle particle, and alſo the greater will be the number of particles coming upon the ſail in the ſame time; the force will be therefore as the ſquares of the velocity.

Again, if the area of the ſail be variable, the force of the wind will be directly as the area or ſuperficies of the ſail, becauſe the number of particles of the air coming upon it will always be proportional thereto, and conſequently the force with which they ſtrike it. Hence if A, S and V repreſent the area, ſine of incidence, and velocity of the wind on one ſail, and a, s, v, thoſe on another; the force compelling the former to turn round will be to that compelling the latter, as $A \times S^2 \times V^2$ to $a \times s^2 \times v^2$.

When the area of the ſail and its poſition in reſpect of the wind continue the ſame, the force which turns the ſail will be as the ſquares of the velocity; and ſince the wind ſcarce ever blows with one uniform velocity, but varies with almoſt every blaſt, the force upon the ſail will be much more variable and unequal; and therefore the action or working of a wind-mill cannot be ſo equal, uniform, and ſteady as that of a water-mill, whoſe power is always of the ſame tenor, while the jet of water is ſo.

If the area of the ſail and the velocity of the wind be ſuppoſed conſtant, the force of the wind in the direct poſition will be to that in the oblique one as $\overline{GC}^2$ to $\overline{GE}^2$, as we have before ſhewn; and it has alſo been ſhewn that that part of the force which turns the ſail is repreſented by EF, when GE is the whole force: But $GE : EF (:: GC : CE) :: \overline{GE}^2 : \frac{CE \times \overline{GE}^2}{GC}$ = to the force which turns the ſail, when the whole force is repreſented by $\overline{GE}^2$, as is here the proper expreſſion of it.

This expreſſion $\frac{CE \times \overline{GE}^2}{GC}$ begins from nothing, when the angle of incidence begins to be oblique, and increaſes with the obliquity of the ſaid angle to a certain number of degrees; becauſe that part of the force which is parallel to the axis becomes leſſer in proportion to that which is perpendicular to it; but after it has paſſed this limit, it again decreaſes, and becomes nothing, when the angle of incidence vaniſhes; as is eaſy to underſtand by conſidering that the quantity of wind on the ſail does in this caſe continually decreaſe.

There is therefore one certain poſition of the ſail, in which the force of the wind is greateſt of all upon it, or a maximum; and to find it, put radius $GC = a$, $EC = x$, and we have $\overline{GE}^2 = aa - xx$, and conſequently the force $\frac{CE \times \overline{GE}^2}{GC} = \frac{aax - xxx}{a}$, which muſt be a maximum: Therefore its fluxion $aa\dot{x} - 3xx\dot{x} = 0$; whence $aa = 3xx$, and ſo $x = \sqrt{\frac{aa}{3}}$, which in logarithms is $\frac{20,000000 - 0,477121}{2}$ 9,761439, which is the logarith ſine of the angle 35° 16′ = angle CGE; and therefore the angle ECG is equal to 45° 44′, when the force of the wind is a maximum, as required.

The angle now found, is only that which gives the wind the greateſt force to put the ſails in motion, but not the angle which gives the force of the wind a maxi-

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mum upon the ſails when they have acquired ſome degree of velocity: to determine this laſt angle it will be neceſſary to premiſe the following lemma.

If a given angle A C B (*fig.* 7.) be divided into two parts A C E, E C B, the product (or ſolid) contained under the ſquare of the ſine E N of the one part E C B, and the ſine M E of the other, will be a maximum, when the ſine of the difference of the parts is one-third of the ſine of the whole given angle.

From E draw Z E T perpendicular to the radius C E, and E R parallel to C B Z. Put C R = x, R E = y, then R T = $\frac{-y\dot{x}}{\dot{y}}$. Now becauſe y^2x muſt be a maximum, we ſhall have $2y\dot{y}x + y\,y\,\dot{x} = 0$; hence $\frac{-y\dot{x}}{\dot{y}} = 2x$; therefore, R T = $2x$, and T Z = 2 Z E. Make C S = C Z, and draw Z H, S P perpendicular to C T, then will S P = $\frac{1}{3}$ Z H. Therefore S P, the ſine of the difference of the angles A C E, E C B to the radius C Z, is juſt one-third of Z H, the ſine of the whole angle A C B to the radius C S = C Z.

Let A B C (*fig.* 8.) repreſent the plane of one of the ſails of a wind-mill, D B the direction and velocity of the wind perpendicular to H B b, the direction in which the ſails turn round their axis. From D let fall D E perpendicular upon C A produced, and let B b repreſent the velocity of the ſails after they have been ſome time in motion; join D b, and draw $b\,e$ parallel to B E. Now it is well known that the efficacy of the wind upon the ſails will be as $\overline{D\,e^2}$ × ſine A B H, or, which is the ſame thing, as ſine $\overline{D\,b\,e^2}$ × ſine bH, which is (by the lemma) a maximum when the ſine of the difference of the angles D $b\,e$, D bH is equal to $\frac{1}{3}$ part of the ſine of the whole given angle B bD: from whence the difference being given, the angles themſelves will be known.

If the velocity of the ſails be ſuppoſed $\frac{1}{8}$, or $\frac{1}{4}$ or $\frac{1}{2}$ of the velocity of the wind, or the ratio of B b to B D be as 1 to 8, 1 to 4, or 1 to 2, then the angle of inclination A B D will be found from hence to = b 58°, 14′, 61° 27′, or 66° 58′, reſpectively; ſo that the greater the velocity of the plane is, the greater alſo will the angle of inclination be. Hence it appears that the ſails of a windmill, that the effect may be the greateſt, ought to be more turned towards the wind in the extreme parts, where the motion is ſwifteſt, than in the parts nearer to the axis of motion, and that in a certain proportion not very difficult to aſcertain from the above inveſtigation.

Mr. Parent has alſo ſhewn that an elliptic form of the ſails is better than the parallelogram or long ſquare; and that the beſt poſition of the ſail is not that which is common, viz. with its longeſt ſide or diameter parallel to the axis of the ſail; but, on the contrary, it ought to be perpendicular to it; that is, they ought to be of ſuch a form, and placed in ſuch a manner, as repreſented in *fig.* 9. and after the four ſails B, C, D, E, are thus placed on the axis or arm A, they are then to be turned about, and fixed under the proper angle of obliquity above-mentioned.

There are three things yet wanting to the perfection of a wind-mill. The firſt is, ſome contrivance in the nature of a fly to regulate the motion of the train, under the irregular and unequal impulſe of the wind. The ſecond is, ſome other contrivance to ſupply the hopper or ſtones with more or leſs corn, in proportion to the greater or leſs ſtrength of the wind. And, thirdly, a method of altering the angle of the ſail's obliquity from its maximum of 54°, 44′ at the beginning of the motion, to its maximum when in motion.

WIND-SAILS, in a ſhip, are made of the common ſail-cloth, and are uſually between twenty-five and thirty feet long, according to the ſize of the ſhip, and are of the form of a cone ending obtuſely: when they are made uſe of, they are hoiſted by ropes to about two thirds or more of their height, with their baſis diſtended circularly by hoops, and their apex hanging downwards in the hatch-ways of the ſhip; above each of theſe, one of the common ſails is ſo diſpoſed, that the greateſt part of the air ruſhing againſt it, is directed into the wind-ſail, and conveyed, as through a funnel, into the upper parts of the body of the ſhip.

WIND-SHOCK, a name given by our farmers to a diſtemperature to which fruit-trees, and ſometimes timber trees, are ſubject. Mortimer is of opinion that the wind-ſhock is a ſort of bruiſe and ſhiver throughout the whole ſubſtance of the tree; but that the bark being often not affected by it, it is not ſeen on the outſide, while the inſide is twiſted round, and greatly injured. It is by ſome ſuppoſed to be occaſioned by high winds; but others attribute it to lightning. Thoſe trees are moſt uſually affected by it, whoſe boughs grow more out on one ſide than on the other.

The beſt way of preventing this in valuable trees, is to take care, in the plantation, that they are ſheltered well, and to cut them frequently in a regular manner, while young. The winds not only twiſt trees in this manner, but they often throw them wholly down: in this caſe the common method is to cut up the tree for firing, or other uſes; but if it be a tree that is worth preſerving, and it be not broken, but only torn up by the roots, it may be proper to raiſe it again, by the following method: let a hole be dug deep enough to receive its roots, in the place where they before were: let the ſtraggling roots be cut off, and ſome of the branches, and part of the head of the tree; then let it be raiſed; and when the torn-up roots are replaced in the earth, in their natural ſituation, let them be well covered, and the hole filled up with rammed earth; the tree will, in this caſe, grow as well, and perhaps better, than before. If nature be left to herſelf, and the tree be not very large, the pulling off the roots will raiſe it.

WIND-TACKLE-BLOCKS, in a ſhip, are the main double blocks, which being made faſt to the end of a ſmall cable, ſerve for hoiſting of goods into the ſhip, &c.

To WIND, or WEND *a ſhip*, ſignifies to bring her head about. *How winds or wends the ſhip?* is a queſtion aſked by mariners, concerning a ſhip under ſail; ſignifying as much as, upon what point of the compaſs does ſhe lie with her head?

WIND-TAUGHT, a ſea-term, ſignifying as much as ſtiff in the wind. See the article TAUGHT.

Too much rigging, high maſts, or any thing catching or holding wind aloft, is ſaid to hold a ſhip wind-taught; by which they mean, that ſhe ſtoops too much in her ſailing in a ſtiff gale of wind. Again, when a ſhip rides in a main ſtreſs of wind and weather, they ſtrike down her top-maſts, and bring her yards down, which otherwiſe would hold too much wind, or be too much diſtended, or wind-taught.

WIND-WARD, in the ſea language, denotes any thing towards that point from whence the wind blows, in reſpect of a ſhip: thus windward-tide, is the tide which runs againſt the wind. See TIDE, &c.

Large WIND. In the ſea-language, to ſail with a large wind, is the ſame as with a fair wind.

Side WIND, at ſea, that which blows on the ſide of the ſhip.

WINDAGE *of a gun*, the difference between the diameter of the bore, and the diameter of the ball.

WINDASS, WANDASS, or WANLASS, an ancient term in hunting: thus, to drive the windlaſs, ſignifies the chaſing a deer to a ſtand where one is ready, with a bow or gun, to ſhoot.

WINDER-MEB, in ornithology, the grey and white laurus, with a yellow beak.

This bird is of the ſize of our widgeon, and at a diſtance appears to be all over white; the head is remarkably large, and rounded; the ears are large, as alſo are the eyes, the iris of which is of a beautiful gold yellow, and the pupil black as jet; the beak is about an inch and a quarter long, conſiderably thick, very much arched and hooked, and pointed at the extremity; the chap is entirely yellow, and has a large protuberance; the legs are very ſlender and yellow; the thighs are naked half the way up; and the feet are webbed.

WINDING STAIRS. See STAIRS.

WINDLASS, or WINDLACE, a machine uſed to raiſe huge weights withal, as guns, ſtones, anchors, &c.

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It is very ſimple, conſiſting only of an axis or roller, ſupported horizontally at the two ends, by two pieces of wood and a pully: the two pieces of wood meet at top, being placed diagonally, ſo as to prop each other; the axis, or roller, goes through the two pieces, and turns in them. The pully is faſtened at top where the pieces join. Laſtly, there are two ſtaves or handſpikes go through the roller, whereby it is turned, and the rope which comes over the pulley is wound off and on the ſame.

WINDLASS, in a ſhip, is an inſtrument in ſmall ſhips, placed upon the deck, juſt abaft the foremaſt. It is made of a piece of timber ſix or eight feet ſquare, in form of an axle-tree, whoſe length is placed horizontally upon two pieces of wood at the ends thereof, and upon which it is turned about by the help of handſpikes put into holes made for that purpoſe. This inſtrument ſerves for weighing anchors, or hoiſting of any weight, in or out of the ſhip, and will purchaſe much more than any capſtan, and that without any danger to thoſe that heave; for if in heaving the windlaſs about, any of the handſpikes ſhould happen to break, the windlaſs would pall of itſelf.

WINDOW, *q. d.* wind-door, an aperture or open place in the wall of a houſe, to let in the wind and light.

We have various forms of windows, as, arched windows, circular windows, elliptical windows, ſquare and flat windows, round windows, oval windows, Gothic windows, regular windows, ruſtic windows, and ſky-lights.

The chief rules in regard to windows, are, 1. That they be as few in number, and as moderate in dimenſions, as may conſiſt with other due reſpects; inaſmuch as all openings are weakenings. 2. That they be placed at a convenient diſtance from the angles, or corners of the building; becauſe that part ought not to be enfeebled, whoſe office is to ſupport and faſten all the reſt of the building. 3. That care be taken that the windows are all equal one with another, in their rank and order; ſo that thoſe on the right hand may anſwer to thoſe on the left, and thoſe above the right over thoſe below; for this ſituation of windows will not only be handſome and uniform, but alſo the void being upon the void, and the full upon the full, it will be a great ſtrengthening to the whole fabric.

As to their dimenſions, care is to be taken not to give them more or leſs light than is needful; that is to make them no bigger, nor leſs, than is convenient; therefore, regard is to be had to the bigneſs of the rooms which are to receive the light: it is evident, that a great room needs more light, and, conſequently, a greater window than a little room, and *è contra*. The apertures of windows, in middle-ſized houſes, may be four and a half or five feet, between the jaumbs, and in greater buildings ſix and a half, or ſeven feet, and their height may be double their length at the leaſt. But in high rooms, or larger buildings, their height may be a third, a fourth, or a half breadth more than double their length. Theſe are the proportions of the windows for the firſt ſtory; and according to theſe muſt the upper ſtories be for breadth; but, as for height, they muſt diminiſh: the ſecond ſtory may be one third part lower than the firſt, and the third one fourth part lower than the ſecond.

WINE, *Vinum*, a liquor made of the expreſſed juice of the grape, which, immediately after preſſure, is called muſt, and being fermented becomes wine.

The goodneſs of wine conſiſts in its being neat, dry, fine, bright, and briſk, without any taſte of the ſoil, of a clean ſteady colour, having a ſtrength without being heady, a body without being ſour, and keeping without growing hard or eager. The difference of flavour, taſte, colour, and body, in wines, is, perhaps, as much owing to the different manner and time of preſſing, gathering, and fermenting the grape, as to any difference of the grape itſelf.

In Hungary, whence tockay and ſome of the richeſt and higheſt-flavoured wines come, they are extremely curious in theſe reſpects: for their prime and moſt delicate wines, the grape is ſuffered to continue upon the vine, till it is half dry by the heat of the ſun; and if the ſun's heat ſhould not prove ſufficient, they are dried by the gentle heat of a furnace, and then picked one by one from the ſtalks; the juice of this grape, when preſſed out, is of a fine flavour, and ſweet as ſugar; this, after due fermentation, is kept for a year, and then racked from the lees, when it proves a generous, oily, rich wine, and is ſold at a very high rate. The Hungarians prepare a ſecond ſort of wine, by collecting together the better kind of grapes, carefully picking the fruit from the ſtalks, and then preſſing out the juice: this is extremely ſweet, and is made richer by infuſing in it, after it has fermented for ſome days, a ſufficient quantity of half-dried grapes. This wine, beſides being very ſweet, is oily, and of a grateful taſte, and retains theſe qualities for a long time.

There is a third ſort, made from the pure juice of this kind of grape, without any addition. This is a more briſk and lively wine, and far leſs ſweet.

They likewiſe prepare a fourth ſort, from grapes of different goodneſs mixed together; this, though not ſo generous, is nevertheleſs an excellent wine.

Theſe Hungarian wines are remarkable for preſerving their ſweetneſs, and for the delicacy of their taſte and ſmell; they, likewiſe, do not grow eaſily vapid, and may be kept in perfection for many years.

Wine being a liquor moſtly of foreign produce, the divers names, forms, kinds, diſtinctions, &c. thereof, are borrowed from the countries where it is produced; the principal whereof, at this day, is France, to wines of which country, a good part of what we have to ſay of this noble liquor, will more immediately belong.

Wine in France is diſtinguiſhed from the ſeveral degrees and ſteps of its preparation, into, 1. *Mere goutte*, mother drop, which is the virgin wine, or that which runs of itſelf out at the top of the vat wherein the grapes are laid, before the vintager enters to tread or ſtamp the grapes. 2. Muſt, ſurmuſt, or ſtum, which is the wine or liquor in the vat, after the grapes have been trod or ſtamped. 3. Preſſed wine, being that ſqueezed with a preſs out of the grapes half bruiſed by the treading. The huſks left of the grapes are called rope, murk, or mark, by throwing water upon which, and preſſing them afreſh, they make a liquor for ſervants uſe, anſwerable to our cyderkin, and called *boiſſon*, which is of ſome uſe in medicine, in the cure of diſorders occaſioned by viſcid humours. 4. Sweet wine, is that which has not yet worked nor fermented. 5. Bouru, that which has been prevented working by caſting in cold water. 6. Worked wine, that which has been let work in the vat to give it a colour. 7. Boiled wine, that which has had a boiling before it worked, and which by that means ſtill retains its native ſweetneſs. 8. Strained wine, that made by ſteeping dry grapes in water, and letting it ferment of itſelf.

Wines are alſo diſtinguiſhed with regard to their colour, into white wine, red wine, claret wine, pale wine, roſe or black wine; and with regard to their country, or the ſoil that produces them, into French wines, Spaniſh wines, Rheniſh wines, Hungary wines, Greek wines, Canary wines, &c. and more particularly into Port wine, Madeira wine, &c.

Method of making, fining, &c. WINE. In the ſouthern parts of France, their way is with red wines to tread or ſqueeze the grapes between the hands, and to let the whole ſtand, juice and huſks, till the tincture be to their liking; after which they preſs it. But for the white wines, they preſs the grapes immediately; when preſſed they tun the muſt and ſtop up the veſſel, only leaving the depth of a foot or more to give room for it to work. At the end of ten days they fill this ſpace with ſome other proper wine, that will not provoke it to work again. This they repeat from time to time, new wine ſpending itſelf a little before it comes to perfection.

The uſual method of fining down wines, ſo as to render them expeditiouſly bright, clear, and fit for uſe, is this. Take an ounce of iſinglaſs, beat it into thin ſhreds with a hammer, and diſſolve it, by boiling, in a pint of water; this when cold becomes a ſtiff jelly. Whiſk up ſome of this jelly into a froth with a little of the

the wine intended to be fined, then ſtir it well among the reſt in the caſk, and bung it down tight; by this means the wine will become bright in eight or ten days.

This method, however, is found to be beſt ſuited to the white wines; for the red ones, the wine-coopers commonly uſe the whites of eggs beat up to a froth, and mixed in the ſame manner with their wines.

They fine it down alſo by putting the ſhavings of green beech into the veſſel, having firſt taken off all the rind, and boiled them an hour in water to extract their rankneſs, and afterwards dried them in the ſun, or in an oven. A buſhel of theſe ſerve for a tun of wine; and being maſhed, they ſerve again and again, till almoſt quite conſumed.

For Engliſh wine the method recommended by Mortimer, is firſt to gather the grapes when very dry, to pick them from the ſtalks, then to preſs them, and let the juice ſtand twenty-four hours in a vat covered. Afterwards to draw it off from the groſs lees, and then put it up in a caſk, and to add a pint or quart of ſtrong red or white port to every gallon of juice, and let the whole work, bunging it up cloſe, and letting it ſtand till January; then bottle it in dry weather. Bradley chuſes to have the liquor, when preſſed, ſtand with the huſks, ſtalks, and all, in the vat, to ferment for fifteen days.

The method of converting white wine into red, ſo much practiſed by the modern wine coopers, Dr. Shaw obſerves is this. Put four ounces of turnſole rags into an earthen veſſel, and pour upon them a pint of boiling water; cover the veſſel cloſe, and leave it to cool; ſtrain off the liquor, which will be of a fine deep red, inclining to purple. A ſmall portion of this colours a large quantity of wine. This tincture might be either made in brandy or mixed with it, or elſe made into a ſyrup, with ſugar, for keeping. A common way with the wine-coopers is to infuſe the rags cold in wine for a night or more, and then wring them out with their hands; but the inconveniency of this method is, that it gives the wine a diſagreeable taſte; or what is commonly called the taſte of the rag; whence the wines thus coloured, uſually paſs among judges for preſſed wines, which have all this taſte from the canvas rags in which the lees are preſſed.

The way of extracting the tincture, as here directed, is not attended with this inconvenience; but it loads the wine with water; and if made into a ſyrup, or mixed in brandy, it would load the wine with things not wanted, ſince the colour alone is required. Hence the colouring of wines has always its inconveniencies.

In thoſe countries which do not produce the tinging grape, which affords a blood-red juice, wherewith the wines of France are often ſtained, in defect of this, the juice of elder-berries is uſed, and ſometimes logwood is uſed at Oporto.

The colour afforded by the method here propoſed, gives wine the tinge of the Bourdeaux-red, not the port; whence the foreign coopers are often diſtreſſed for want of a proper colouring for red wines in bad years. This might perhaps be ſupplied by an extract made by boiling ſtick-lack in water. The ſkins of tinging grapes might alſo be uſed, and the matter of the turnſole procured in a ſolid form, not imbibed in rags.

Stahl obſerves, that it is a common accident, and a diſeaſe in wines, to be kept too hot; which is not eaſy to cure when it has been of any long continuance, otherwiſe it may be cured by introducing a ſmall artificial fermentation, that new ranges the parts of the wine, or rather recovers their former texture: but the actual expoſing of wine to the fire, or the ſun, preſently diſpoſes it to turn eager; and the making it boiling hot, is one of the quickeſt ways of expediting the proceſs of making of vinegar. On the other hand, wine kept in a cool vault, and well ſecured from the external air, will preſerve its texture intire in all the conſtituent parts, and ſufficiently ſtrong for many years, as appears not only from old wines, but other foreign fermented liquors, particularly thoſe of China, prepared from a decoction of rice, which being well cloſed down in a veſſel, and buried deep under ground, will continue for a long ſeries of years, rich, generous, and good, as the hiſtories of that country univerſally agree in aſſuring us.

The moſt general remedy hitherto known for all the diſeaſes of wines, is a prudent uſe of tartarized ſpirit of wine, which not only enriches, but diſpoſes all ordinary wines to grow fine.

WING, *Ala*, that part of a bird, inſect, &c. whereby it is enabled to fly.

Willoughby obſerves, that all birds whatſoever have wings, or rudiments of wings, which anſwer to the forelegs in quadrupeds. Among land fowl he obſerves, that the oſtrich, caſſowary, and dodo; and among water-fowl, the pengune, have wings altogether uſeleſs and unfit for flight.

Inſects, indeed, have wings, and ſo have bats, but of a different kind from thoſe of birds; the former being membranaceous, and the latter cutaneous: birds only have wings made up of feathers. All birds, towards the extremity of their wings, have a certain finger-like appendix, which is commonly called the ſecondary or baſtard-wing. It is made up of four or five ſmall feathers. Beſides this, under the wing, or on the inſide of the wing, ſome birds, eſpecially water-fowl, have a row of feathers growing, called interior baſtard-wing, which in moſt birds is of a white colour.

Reaumur obſerves, that wings among the fly-claſs, afford ſeveral ſubordinate diſtinctions of the genera of thoſe animals, under the antient general claſſes. Several ſpecies of flies, while they are in a ſtate of reſt, or only walking, ſhew ſeveral regularly diſtinct manners of carrying their wings. The much greater number, however, carry them in a parallel or plain poſition. Among thoſe who carry them thus, ſome have them in form of a ſort of oars, their direction being perpendicular to the length of the body, which is not at all covered by them. Others carry their wings in this manner, ſo as that they cover a part of the body, without at all covering one another. The wings of others croſs one another on the body of the creature, and the degrees in which they cover one another, give occaſion to ſeveral other ſub-diſtinctions; for ſome of them overhang on each ſide of the body of the animal, while others croſs one another, in ſuch a manner as not to cover the body of the fly entirely, but leave a rim of it viſible and uncovered on each ſide of them. Some of the flies bred of water-worms, have their wings in this manner. Others have their wings thus diſpoſed, but croſſing one another only in a part of their ſurface, and that at their extremities; ſo that though they there cover the body of the fly, they leave a portion of the anterior part of the body naked.

The beautiful wings of butterflies are diſtinguiſhed from thoſe of the fly kind, by their not being thin and tranſparent, like them, but thicker and opake. This opacity in them is only owing to the duſt which comes off them, and ſticks to the fingers in handling them; and it is alſo to this duſt that they owe all their beautiful variety of colours. The earlier naturaliſts, for this reaſon, diſtinguiſhed theſe inſects by the appellation of ſuch as had farinaceous wings.

The wings of gnats are of a very curious ſtructure, and well worthy the uſe of the microſcope, to ſee them diſtinctly. It is well known, that on touching the wings of butterflies, a coloured powder is left on the fingers, which, though to the naked eye it appears a mere ſhapeleſs duſt, yet, when examined by the microſcope, it is found to be very regularly figured beautiful bodies, in form of feathers and ſcales: theſe are of various figures, and all of them very elegant. The generality of flies have nothing of this kind; but the cloſe examination of the wings of the gnat will ſhew, that they are not wholly deſtitute of them: they are much more ſparingly beſtowed, indeed, upon the gnat than on the butterfly; but then they are arranged with great regularity.

WINGS, in heraldry, are borne ſometimes ſingle, ſometimes in pairs; in which caſe they are called conjoined. When the points are downward, they are ſaid to be inverted; when up, elevated.

WING, in botany, the angle formed between the ſtem and the leaves or pedicles of the leaves of a plant.

WINGS, *Alæ*, in military affairs, are the two flanks or extremes of an army, ranged in form of a battle; being the right and left ſides thereof.

WINGS, in fortification, denote the longer ſides of horn-works, crown-works, tenailles, and the like out-works; including the ramparts and parapets, with which they are bounded on the right and left from their gorge to their front.

WINGED-LEAVES, in botany, are thoſe which are compoſed of ſeveral folioli, or little leaves, ranged on each ſide the common footſtalk like wings; but as theſe are diſpoſed in different forms, ſo they have different appellations. See PINNATE.

WINGED-SEEDS, are thoſe which are furniſhed with down or hairs, by the help of which they are buoyed up in the air, and carried a conſiderable diſtance; ſuch are thoſe of the dandelion, ſowthiſtle, &c.

WINNOW, ſignifies to fan or ſeparate corn from the chaff by the wind.

WINTER, one of the four ſeaſons or quarters of the year.

Winter commences on the day when the ſun's diſtance from the zenith of the place is greateſt, and ends on the day when its diſtance is at a mean between the greateſt and leaſt.

Notwithſtanding the coldneſs of the ſeaſon, it is proved by aſtronomers, that the ſun is really nearer the earth in winter than in ſummer.

Under the equator, the winter as well as other ſeaſons, return twice every year; but all other places have only one winter in the year, which in the northern hemiſphere begins when the ſun is in the tropic of Capricorn, and in the ſouthern hemiſphere when in the tropic of Cancer; ſo that all places in the ſame hemiſphere have their winter at the ſame time.

WINTER, among printers, that part of the printing preſs ſerving to ſuſtain the carriage.

WINTER'S-BARK, *Cortex Winteranus*, in botany, a name given to the bark of the white or wild cinnamon tree.

The winter's bark is a thick and firm bark, though we have a different thing ſometimes under its name: it comes to us rolled up in the manner of the common cinnamon, into a kind of tubes or pipes; but they are uſually thicker, and always ſhorter than the fine tubes of cinnamon. It is externally of a greyiſh colour, and of a reddiſh brown within; it is properly indeed a double bark, the outer and inner of the ſame tree, not the inner bark alone, ſeparated from the other, as the cinnamon and caſſia are. The outer rind is of an uneven ſurface and of a looſe texture, very brittle, and eaſily powdered. The inner bark, which has the principal virtue, is hard, and of a duſky reddiſh brown. The outer one is often cracked and open in ſeveral places, the inner one never in any. It is of an extremely fragrant and aromatic ſmell, and of a ſharp, pungent, and aromatic taſte, much hotter than cinnamon in the mouth, and leaving a more laſting flavour on it.

It is to be choſen in pieces not too large, with the inner or brown part ſound and firm, and of a very ſharp taſte. It is apt to be worm-eaten; but in that caſe it is wholly to be rejected, as having loſt the far greater part of its virtue.

The cortex Winteranus was wholly unknown to the ancients; the diſcovery of it among us is owing to Capt. Winter, who, in the year 1567, going as far as the Streights of Magellan with Sir Francis Drake, found this bark on that coaſt, and bringing a large quantity of it with him in his return to England, it became uſed in medicine, and was ever after called by his name. It is not, however, peculiar to the place he found it in, but is frequent in many parts of America.

The virtues of this bark were diſcovered by the Engliſh ſailors on board captain Winter's ſhip; they firſt uſed it by way of ſpice to their foods, and afterwards for the ſcurvy. It is alſo good in palſies and rheumatiſms; and a decoction of the leaves is good, by way of fomentation, for the parts externally affected by the ſcurvy. The Engliſh ſailors made it famous for its virtues againſt the poiſon of a certain fiſh, common about the Magellanic ſea, which they called the ſea-lion: they eat the fleſh of this fiſh, and fell into many illneſſes by it; among which was one attended with a peeling off of the ſkin of their whole bodies, not without exceſſive pain; this they remedied by the cortex Winteranus: but by the accounts we have of the effects of eating this fiſh, as it is called, they were rather ſymptoms of an inveterate ſcurvy, and, therefore, it is no wonder this bark did them great ſervice.

WINTER-RIG, among huſbandmen, ſignifies to fallow or till the land in winter.

WINTER-SOLSTICE. See the article SOLSTICE.

WINTERANA, in botany, a genus of plants, whoſe flower conſiſts of five oblong ſeſſile petals, with a conic, concave, pitcher ſhaped nectarium: the ſtamina hath no filaments, but conſiſts of ſixteen linear antheræ: the fruit is a roundiſh berry with three cells, each containing two heart-ſhaped ſeeds.

WIRE, a piece of metal drawn through the hole of an iron into a thread, of a fineneſs anſwerable to the hole it paſſed through.

Wires are frequently drawn ſo fine, as to be wrought along with other threads of ſilk, wool, flax, &c.

The metals moſt commonly drawn into wire, are gold, ſilver, copper, and iron. Gold wire is made of cylindrical ingots of ſilver, covered over with a ſkin of gold, and thus drawn ſucceſſively through a vaſt number of holes, each ſmaller and ſmaller; till at laſt it is brought to a fineneſs exceeding that of a hair. That admirable ductility which makes one of the diſtinguiſhing characters of gold, is no where more conſpicuous, than in this gilt wire. A cylinder of forty-eight ounces of ſilver, covered with a coat of gold, only weighing one ounce, as Dr. Halley informs us, is uſually drawn into a wire, two yards of which weigh no more than one grain; whence ninety-eight yards of the wire weigh no more than forty-nine grains, and one ſingle grain of gold covers the ninety-eight yards; ſo that the thouſandth part of a grain is above one-eighth of an inch long. The ſame author, computing the thickneſs of the ſkin of gold, found it to be $\frac{1}{1144300}$ part of an inch. Yet ſo perfectly does it cover the ſilver, that even a microſcope does not diſcover any appearance of the ſilver underneath. M. Rohault likewiſe obſerves, that a like cylinder of ſilver, covered with gold, two feet eight inches long, and two inches nine lines in circumference, is drawn into a wire 307200 feet long, i. e. into 115200 times its former length. Mr. Boyle relates, that eight grains of gold, covering a cylinder of ſilver, is commonly drawn into a wire 13000 feet long. See the articles GOLD and DUCTILITY.

Silver-wire is the ſame with gold-wire, except that the latter is gilt, or covered with gold, and the other is not.

There are alſo counterfeit gold and ſilver-wires; the firſt made of a cylinder of copper, ſilvered over, and then covered with gold; and the ſecond of a like cylinder of copper, ſilvered over, and drawn through the iron, after the ſame manner as gold and ſilver-wire.

Braſs-wire is drawn after the ſame manner as the former. Of this there are divers ſizes, ſuited to the different kinds of works. The fineſt is uſed for the ſtrings of muſical inſtruments, as ſpinets, harpſichords, manichords, &c.

The pin-makers, likewiſe, uſe vaſt quantities of braſs-wire, to make their pins of. Iron-wire is drawn of various ſizes, from half an inch to one tenth of an inch diameter.

The firſt iron that runs from the ſtone, when melting, being the ſofteſt and tougheſt, is preſerved to make wire of. Iron-wire is made from ſmall bars of iron called eſleom-iron, which are firſt drawn out to a greater length, and to about the thickneſs of one's little-finger, at a furnace, with a hammer gently moved by water. Theſe thinner pieces are bored round, and put into a furnace to aneal for twelve hours. A pretty ſtrong fire is uſed for this operation. After this they are laid under water for three or four months, the longer the better; then they are delivered to the workmen, called rippers, who

draw them into wire through two or three holes. After this they aneal them again for ſix hours, and water them a ſecond time for about a week, and they are then delivered again to the rippers, who draw them into wire of the thickneſs of a large packthread. They are then anealed a third time, and then watered for a week longer, and delivered to the ſmall wire-drawers, called overhouſe-men.

In the mill where this work is performed, there are ſeveral barrels hooped with iron, which have two hoops on their upper ſides, on each whereof hang two links which ſtand acroſs, and are faſtened to the two ends of the tongs, which catch hold of the wire, and draw it through the hole. The axis on which the barrel moves does not run through the center, but is placed on one ſide, which is that on which the hooks are placed; and underneath there is faſtened to the barrel a ſpoke of wood, which they call a ſwingle, which is drawn back a good way by the cogs in the axis of the wheel, and draws back the barrel, which falls to again by its own weight. The tongs hanging on the hooks of the barrel, are by the workman faſtened to the end of the wire, and by the force of the wheel, the hooks being pulled back, draw the wire through the holes. The plate in which the holes are, is iron on the outſide, and ſteel on the inſide; and the wire is anointed with train-oil, to make it run the eaſier.

WIRE *of Lapland*. The inhabitants of Lapland have a ſort of ſhining ſlender ſubſtance in uſe among them on ſeveral occaſions, which is much of the thickneſs and appearance of our ſilver wire, and is therefore called, by thoſe who do not examine its ſtructure or ſubſtance, Lapland-wire. It is made of the ſinews of the reindeer, which being carefully ſeparated in the eating, are, by the women, after ſoaking in water, and beating, ſpun into a ſort of thread, of admirable fineneſs and ſtrength, when wrought to the ſmalleſt filaments; but, when larger, is very ſtrong, and fit for the purpoſes of ſtrength and force. Their wire, as it is called, is made of the fineſt of theſe threads, covered with tin. The women do this buſineſs, and the way they make it is to mill a piece of tin, and placing at the edge of it a horn with a hole through it, they draw theſe ſinewy threads, covered with the tin, through the hole, which prevents their coming out too thick covered. This drawing is performed with their teeth; and there is a ſmall piece of bone placed at the top of the hole, where the wire is made flat, ſo that we always find it rounded on all ſides but one, where it is flat.

This wire they uſe in embroidering their cloaths as we do gold and ſilver; they often ſell it to ſtrangers, under the notion of its having certain magical virtues.

WISDOM, *Sapientia*, uſually denotes a higher and more refined notion of things immediately preſented to the mind, as it were, by intuition, without the aſſiſtance of ratiocination.

In this ſenſe wiſdom may be ſaid to be a faculty of the mind, or at leaſt a modification and habit thereof.

Sometimes the word is more immediately uſed, in a moral ſenſe, for what we call prudence, or diſcretion, which conſiſts in the ſoundneſs of the judgment, and a conduct anſwerable thereto.

WIT, a faculty of the mind, conſiſting, according to Mr. Locke, in the aſſembling and putting together of thoſe ideas, with quickneſs and variety, in which any reſemblance or congruity can be found, in order to form pleaſant pictures and agreeable viſions to the fancy. This faculty, the ſame author obſerves, is juſt the contrary of judgment, which conſiſts in the ſeparating carefully from one another ſuch ideas wherein can be found the leaſt difference, thereby to avoid being miſled by ſimilitude and affinity, to take one thing for another. It is the metaphor and alluſion, wherein, for the moſt part, lies the entertainment and pleaſantry of wit, which ſtrikes ſo lively on the fancy, and is therefore ſo acceptable to all people, becauſe its beauty appears at firſt ſight, and there is required no labour of thought to examine what truth or reaſon there is in it. The mind, without looking any farther, reſts ſatisfied with the agreeableneſs of the picture, and the gaiety of the imagination; and it is a kind of affront to go about to examine it by the ſeveral rules of truth or reaſon.

WIT is alſo an appellation given to the perſon poſſeſſed of this faculty: and here the true wit muſt have a quick ſucceſſion of pertinent ideas, and the ability of arranging and expreſſing them in a lively and entertaining manner; he muſt at the ſame time have a great deal of energy and delicacy in his ſentiments; his imagination muſt be ſprightly and agreeable, without any thing of parade or vanity in his diſcourſe: but it is not, however, eſſential to the character of a wit, to be ever hunting after the brilliant, ſtudying ſprightly turns, and affecting to ſay nothing but what may ſtrike and ſurpriſe.

WITCHCRAFT, a kind of ſorcery, eſpecially in women, in which it is ridiculouſly ſuppoſed that an old woman, by entering into a contract with the devil, is enabled, in many inſtances, to change the courſe of nature; to raiſe winds; perform actions that require more than human ſtrength; and to afflict thoſe who offend them with the ſharpeſt pains, &c. In the times of ignorance and ſuperſtition, many ſevere laws were paſſed againſt witches, by which great numbers of innocent perſons, diſtreſſed with poverty and age, were brought to a violent death; but theſe are now happily repealed.

WITENA-MOT, or WITENA-GEMOT, among our Saxon anceſtors, was a term which literally ſignified the aſſembly of the wiſe men, and was applied to the great council of the nation, of latter days called the parliament.

WITHERS *of a Horſe*, the juncture of the ſhoulder-bones at the bottom of the neck and mane, towards the upper part of the ſhoulder.

WITNESS, in law, a perſon who gives evidence in any cauſe, and is ſworn to ſpeak the truth, the whole truth, and nothing but the truth.

A witneſs ought to be indifferent with reſpect to each party; for if he will be a gainer or loſer by the ſuit, he is not ſworn as a witneſs.

Falſe witneſſes, ſuborners of witneſſes, &c. are in England puniſhed with the pillory; in ſeveral other countries with death.

WOAD, *Iſatis*, in botany, a genus of plants, the flower of which conſiſts of four leaves, which are diſpoſed in form of a croſs; out of whoſe flower-cup riſes the pointal, which afterward turns to a fruit in the ſhape of a tongue, flat at the edges, gaping two ways, having but one cell; in which is contained, for the moſt part, one oblong ſeed.

Woad is commonly ſown upon a lay, which they plow into high ridges, except the land be very dry; and they harrow the turf till they break it to pieces, and pick out all the graſs, weeds, and lumps of earth, and fling them into the furrows to rot.

The land for this ſeed ought to be finely plowed and harrowed, and all the clods and turfs broken, and the ſtones picked up, and carried off.

The beſt time for ſowing it is the latter end of July, ſoon after the ſeed is ripe; which will come up in Auguſt, and muſt be hoed out, as is practiſed for turneps, leaving the plants ten or twelve inches aſunder; by which means they will grow ſtrong, and produce much larger leaves; and beſides, that ſown at this ſeaſon doth ſeldom miſcarry; whereas that which is ſown in the ſpring will be very liable thereto; and if it doth not, the plant will not have half the ſtrength the firſt ſummer. It ought to be kept conſtantly weeded; but if it come up good, it will need the leſs weeding: the ordinary price of weeding is eight ſhillings per acre.

Some recommend the ſowing of it about the beginning of February; for which they give this reaſon, that whereas it is apt to be ſpoiled by the fly and grub, it eſcapes the better being early ſown; and if they do kill any of it, they have the better opportunity of ſowing more.

They do this by making holes with a ſtick about ſeven or eight inches aſunder, and put five or ſix ſeeds into each hole. They ſeldom or never ſow it more than two years upon the ſame piece of land; becauſe, if it be long continued, it robs the ſoil: but if it be moderately uſed, it

prepares

prepares land for corn; and where the ſoil is rank, it abates the too great fertility of it.

It is ripe, when the leaf is come to its full growth, and retains its perfect colour and lively greenneſs; which is ſometimes ſooner, and ſometimes later, as the year proves dry or moiſt. As ſoon as it is fit to cut, it ſhould be done with all the ſpeed that poſſibly may be, that it may not fade, or grow pale; and when it is cut, it ought to be immediately carried to the mill. The manner of doing which, and the way of ordering it, is beſt learned from experienced workmen, and is not to be truſted to a verbal deſcription of it.

In plowing it up, and ſowing it again, they pick up all the old roots, as they harrow it, except what they deſign for ſeed, which they let ſtand to the next year: it many times produces fifty quarters upon an acre.

They always keep a good quantity of ſeed by them, to plant the ground that fails; the ſeed of two years will ſometimes grow; but as it is apt to fail, it is better to ſow that of the firſt. And if they ſow or plant it late, if the ground be dry and hard, they ſteep it in water the day before they ſow it, which cauſes it to come up the ſooner.

Good woad may yield five or ſix crops in a plentiful year; though it ordinarily yields but four, ſometimes but three; eſpecially if it be let ſtand to grow for ſeed: but what grows in winter they do not uſe, though it is very good and very cheap. The two firſt crops are the beſt, which are uſually mixed in the ſeaſoning. The latter crops are much the worſe; which, if mixed with either of the former crops, ſpoil the whole.

It many times ſells from ſix pounds to thirty pounds a ton, an acre commonly yielding about a ton. *Miller's Gard. Dict.*

WOLD, ſignifies a plain, down, or open champaign ground, hilly and void of wood.

WOLF, *Lupus*, in zoology, a very large and fierce animal, being equal to the biggeſt maſtiff in ſize, and having much of the general appearance of that creature: the head is large and fleſhy: the eyes are large and prominent, and their iris hazel: the ears are ſhort, patulous, and erect: the teeth are very large, and the animal has a way of ſhewing them in a frightful manner, by grinning: the neck is robuſt and thick: the body is large, and the back broad: the legs are very robuſt: the tail is long and buſhy: the natural colour is black, but there are ſome tawny; and in ſome places they are in winter perfectly white. The wolf is a very miſchievous creature, deſtroying cattle; and in hard winters attacking houſes and villages in whole troops.

WOLF'S BANE, in botany, the Engliſh name for the aconitum. See ACONITE.

WOLVES TEETH, of an horſe, are over-grown grinders, the points of which being higher than the reſt, prick his tongue and gums in feeding, ſo as to hinder his chewing. They are ſeldom met with in any beſides young horſes; but if they be not daily worn by chewing, they will grow up even to pierce the roof of the mouth.

WOMAN, *Fœmina*, in zoology, the female of man. See MAN.

WOMB, *Uterus*. See UTERUS.

WOOD, *Lignum*, a ſolid ſubſtance, of which the branches of trees conſiſt, and deriving its growth from certain juices of the earth.

The ſtructure and organiſation of wood is a ſubject on which many have employed their thoughts; but perhaps none with greater ſucceſs than the celebrated Monſieur Buffon, of the Royal Academy of Sciences at Paris.

This gentleman obſerves, that the organiſation of wood is yet unknown in all its parts; and, that though the world is greatly indebted to the obſervations of Grew, Malpighi, and Hales, yet, when he entered on the ſubject, he found there was much more unknown than known, and determined to obſerve, from its firſt ſtate, the growth of trees, and the formation of their woody part.

The ſeed of a tree, ſuppoſe an acorn, if put into the earth in the ſpring ſeaſon, produces, after a few weeks, a tender ſhoot, of an herbaceous ſtructure, which enlarges, extends itſelf, and hardens by degrees, and, in the firſt year's growth, has in it a ſlender filament of a woody ſubſtance. At the extremity of this young tree there is a little button formed, which opens the next year into leaves, and from which there is propagated a ſecond ſhoot, in all reſpects like that of the firſt year, except that it is more vigorous, grows faſter, and hardens much more conſiderably. This is alſo terminated by a button like that of the precedent year; and in this is contained the ſhoot of the third year; and in this manner is the growth of the tree carried on, till it has acquired its whole height.

Each of theſe buttons is a ſort of ſeed, which contains the ſhoot of the ſucceeding year, juſt as the ſeed itſelf did that of the firſt; and the growth of a tree in height is carried on, therefore, by a ſeries of annual productions, exactly like one another; and the full grown tree is, though perhaps a hundred feet high, compoſed only of a number of ſhort trees, joined end to end, the longeſt of which is not above two feet in length. Theſe little trees of the ſeveral years never at all alter their height or length, or even their thickneſs; they remain even in a tree of a hundred years old, of their original length and diameter, and ſuffer no change, but in becoming harder. This then is the manner in which trees grow in height; how they grow in thickneſs is next to be inquired into.

The button which makes the ſummit of the tree of the firſt year, draws its nouriſhment through the very ſubſtance of that little tree; but the principal tubes or veſſels which ſerve to convey the ſap, are placed between the bark and the woody filament.

The action of this ſap, in moving, dilates and enlarges theſe veſſels, while the button, in raiſing itſelf up in growth, elongates them; the ſap alſo, in continually paſſing them, leaves behind it certain fixed parts, which augment the ſolidity. Thus the ſecond year's little tree contains in its middle a woody filament in form of an elongated cone, which is the production of the wood of a former year, and a woody bed for it, which is alſo of a conic ſhape, and which ſurrounds the firſt filament, and reaches beyond it in length; and this is the production of the ſecond year. The third bed forms itſelf altogether like the ſecond, and all the ſucceeding ones are formed by the ſame law, and in the ſame order, and envelope one another in a continued ſucceſſion or ſeries, ſo that a large tree is compoſed of a number of woody cones, which enfold, cover, and envelope one another, as the tree increaſes in thickneſs.

When the tree comes to be cut down, one eaſily counts, in a tranſverſe ſection of the trunk, the number of theſe cones, the ſection of which make ſo many concentric circles; and the age of the tree is known by the number of theſe circles, for they are diſtinctly ſeparate from one another; in a vigorous and well grown oak, theſe lines are each of a ſixth of an inch or more in thickneſs, and the ſubſtance of theſe lines or circles is very hard and firm, but the ſubſtance of the wood, which lies between, and unites theſe together, is much leſs ſo. This intermediate matter is always the weak part of the wood, and its ſtructure and organiſation is perfectly different from that of the woody cones, and depends entirely on the manner in which theſe cones are united to one another. This is explained in the following manner:

The veſſels, which are longitudinally diſpoſed in the wood, and convey the nouriſhment to the bottom, not only are extended and hardened by the action of the ſap in motion, and by the firm particles it depoſits; but they are ever attempting alſo an extenſion of another kind; they are ramified all along as they go, and break into numberleſs extremely minute filaments, which iſſue from them like ſo many branches; theſe, on the one part, are deſtined to the production of the bark of the tree; and, on the other, are connected to the wood of the preceding year, and from between the two woody beds, a ſort of ſpungy reticular work, which, when cut tranſverſely, even to a great thickneſs, ſhews numberleſs little cavities and holes, reſembling a ſort of lace-work. The woody beds are therefore united to one another by a ſort of net-work; this net-work, however, does

does not occupy nearly the ſpace of the woody circles which it ſeparated, and is uſually indeed but about the ſixth part of their thickneſs. This thickneſs is much the ſame in all the trees of the ſame ſpecies, whereas the woody beds vary in them very conſiderably in thickneſs: in the oak they are found from a ſixth to a four and twentieth part of an inch in thickneſs.

By this eaſy expoſition of the texture of wood, it is eaſy to diſcover that the longitudinal coherence of the particles of it muſt needs be vaſtly greater than the tranſverſe: one ſees alſo that, in little pieces of wood, as in a bar of an inch thickneſs, if there are fourteen or fifteen of theſe woody beds, there will alſo be thirteen or fourteen of theſe intermediate ſpaces; and conſequently it will be much weaker than if there were but five or ſix of theſe woody beds in it, and conſequently but four or five of theſe intermediate ſpaces.

It may alſo be obſerved, that in thoſe little bars of wood there are two or three of the woody beds wounded, which is often the caſe; the ſtrength of the bar muſt be thence greatly impaired: but the greateſt fault theſe ſmall pieces of wood are ſubject to, is the different diſpoſition of theſe beds in the different parts of the ſame tree; and this difference is ſo great, that the force or ſtrength of a large beam of any wood cannot be computed by proportion, from that of a ſmall piece of the ſame wood; which, were it poſſible, would make calculations of this kind extremely eaſy. The ingenious author of this paper has from hence calculated the force and ſtrength of timber uſed in building. *Memoires Acad. Par.* 1740.

The people who work much in wood, and that about ſmall works, find a very ſurpriſing difference in it, according to the different ſeaſons at which the tree was cut down, and that not regularly the ſame in regard to all ſpecies, but different in regard to each. The button-mould makers find that the wood of the pear tree, cut in ſummer, works hardeſt: holly, on the contrary, works tougheſt when cut in winter; box is melloweſt when it has been cut in ſummer, but hardeſt when cut about Eaſter; hawthorn works mellow when cut about October, and the ſervice is always tough, if cut in ſummer.

Mortimer obſerves, that all kinds of wood are to be preſerved from the worm, and from many other occaſions of decay, by oily ſubſtances, particularly the eſſential oils of vegetables. Oil of ſpike is excellent; and oil of juniper, turpentine, or any other of this kind, will ſerve the purpoſe; theſe will preſerve tables, inſtruments, &c. from being eaten to pieces by theſe vermin; and linſeed-oil will ſerve, in many caſes, to the ſame purpoſe: probably nut-oil will do alſo, and this is a ſweeter oil, and a better varniſh for wood.

Some of the Weſt-Indian trees afford a ſort of timber, which, if it would anſwer in point of ſize, would have great advantages over any of the European wood in ſhip-building for the merchant-ſervice, no worm ever touching this timber. The acajou, or tree which produces the caſhew-nut, is of this kind; and there is a tree of Jamaica, known by the name of the white-wood, which has exactly the ſame property: and ſo have many other of theſe trees.

To ſeaſon wood expeditiouſly for ſea-ſervice, Mr. Boyle obſerves, that it has been uſual to bake it in ovens.

The art of moulding wood is mentioned by Mr. Boyle as a deſideratum in the art of carving. He ſays, he had been credibly informed of its having been practiſed at the Hague; and ſuſpects that it might have been performed by ſome menſtruum that ſoftens the wood, and afterwards allows it to harden again, in the manner that tortoiſe-ſhell is moulded: or, perhaps, by reducing the wood into a powder, and then uniting it into a maſs with ſtrong but thin glue. And he adds, that having mixed ſaw-duſt with a fine glue made of iſing-glaſs, ſlightly ſtraining out what was ſuperfluous through a piece of linen, the remainder, formed into a ball and dried, became ſo hard as to rebound when thrown againſt the floor.

Wood uſed for fuel is required of various kinds, in regard to the various works to be performed by it.

Neri every where commends oak for the wood to be burnt in the glaſs-houſes, as the propereſt wood for making a ſtrong and durable fire with a good flame.

Imperato, on the contrary, recommends aſh on the ſame occaſion; becauſe, as he ſays, it gives a ſubſtantial, rather than a great flame: and Camerarius deſervedly commends juniper wood, as affording a laſting, ſtrong, and ſweet fire, could plenty of it be had. Among the ancients, Pliny commends light dry wood; and Plutarch, the tamariſk in particular, for making the glaſs-houſe-fires; but glaſs-making requires ſo great a fire as cannot be eaſily made with wood. Nor can aſh be proper, becauſe, though it gives a good fire, it ſoon decays.

Woods are diſtinguiſhed into divers kinds, with regard to their nature, properties, virtues, and uſes. Of wood, conſidered according to its qualities, whether uſeful, curious, medicinal, &c. the principal is called timber, uſed in building houſes, laying floors, roofs, machines, &c. See TIMBER.

The medicinal woods are guaiacum, aloes, ſaſſafras, nephiticum, ſantal, ſarſaparilla, aſpalathum, &c.

Woods uſed in dying are the Indian wood, Brazil wood, Campeachy wood, &c.

Foſſile WOOD. Foſſile wood, or whole trees, or parts of them, are very frequently found buried in the earth, and that in different ſtrata; ſometimes in ſtone, but more uſually in earth; and ſometimes in ſmall pieces looſe among gravel. Theſe, according to the time they have lain in the earth, or the matter they have lain among, and in the way of, are found differently altered from their original ſtate; ſome of them having ſuffered very little change, and others being ſo highly impregnated with cryſtalline, ſparry, pyritical, or other extraneous matter, as to appear mere maſſes of ſtone, or lumps of the common matter of the pyrites, &c. of the dimenſions, and, more or leſs, of the internal figure of the vegetable bodies into the pores of which they have made their way.

The foſſile woods which we find at this day, are, according to theſe differences, arranged, by Dr. Hill, into three kinds; 1. the leſs altered; 2. the pyritical: and, 3. the petrified.

Of the trees, or parts of them, leſs altered from their original ſtate, the greateſt ſtore is found in digging to ſmall depths in bogs, and among what is called peat or turf-earth, a ſubſtance uſed in many parts of the kingdom for fuel. In digging among this, uſually very near the ſurface, they find immenſe quantities of vegetable matter buried, and that of various kinds: in ſome places there are whole trees ſcarce altered, except in colour; the oaks in particular being uſually turned to a jetty black; the pines and firs, which are alſo very frequent, are leſs altered, and are as inflammable as ever, and often contain, between the bark and wood, a black reſin. Large parts of trees have alſo been not unfrequently met with unaltered in beds of another kind, and at much greater depths, as in the ſtrata of clay and loam, among gravel, and ſometimes even in ſolid ſtone.

Beſides theſe harder parts of trees, there are frequently found alſo in peat-earth vaſt quantities of leaves and fruit, and catkins of the hazel, and the like trees: theſe are uſually intermixed among the ſedge and roots of graſs, and are ſcarce at all altered from their uſual texture. The moſt common of theſe are hazel nuts; but there are frequently found alſo the twigs and leaves of the white poplar; and a little deeper uſually there lies a cracked and ſhattered wood, the crevices of which are full of a bituminous black matter; and among this the ſtones of plums, and other ſtone-fruits, are ſometimes found, but that more rarely.

The irregular maſſes or fragments of wood are principally of oak, and are moſt uſually found among gravel, though ſometimes in other ſtrata. Theſe are variouſly altered by the inſinuation of cryſtalline and ſtony particles, and make a very beautiful figure when cut and poliſhed, as they uſually keep the regular grain of the wood, and ſhew exactly the ſeveral circles which mark the different years growth. Theſe, according to the different matter which has filled their pores, aſſume various colours, and the appearance of the various foſſils that

have impregnated them; ſome are perfectly white, and but moderately hard; others of a browniſh black, or perfectly black, and much harder; others of a reddiſh black, others yellowiſh, and others greyiſh, and ſome of a ferrugineous colour. They are of different weights alſo and hardneſſes, according to the nature and quantity of the ſtony particles they contain: of theſe ſome pieces have been found with every pore filled with pure pellucid cryſtal; and others in large maſſes, part of which is wholly petrified and ſeems mere ſtone, while the reſt is crumbly and is unaltered wood. That this alteration is made in wood, even at this time, is alſo abundantly proved by the inſtances of wood being put into the hollows of mines, as props and ſupports to the roofs, which is found after a number of years as truly petrified as that which is dug up from the natural ſtrata of the earth. In the pieces of petrified wood found in Germany, there are frequently veins of ſpar or of pure cryſtal, ſometimes of earthy ſubſtances, and often of the matter of the common pebbles: theſe fragments of wood ſometimes have the appearance of parts of the branches of trees in their natural ſtate; but more frequently they reſemble pieces of broken boards; theſe are uſually capable of a high and elegant poliſh.

Many ſubſtances, it is certain, have been preſerved in the cabinets of collectors, under the title of petrified wood, which have very little right to that name. But where the whole outer figure of the wood, the exact lineaments of the bark, or the fibroſe or fiſtular texture of the ſtriæ, and the veſtiges of the utriculi and tracheæ, or air-veſſels, are yet remaining, and the ſeveral circles yet viſible, which denoted the ſeveral years growth of the tree, none can deny theſe ſubſtances to be real foſſil wood.

WOOD, *Sylva*, in geography, a multitude of trees extended over a large continued tract of land, and propagated without culture. The generality of woods only conſiſt of trees of one kind.

The ancient Saxons had ſuch a veneration for woods, that they made them ſanctuaries.

It is ordained, that none ſhall deſtroy any wood, by turning it into tillage or paſture, &c. where there are two acres or more in quantity, on pain of forfeiting 40 s. an acre, by 35 Hen. VIII. c. 17. All woods that are felled at fourteen years growth, are to be preſerved from deſtruction for eight years; and no cattle put into the ground till five years after the felling thereof, &c. 13. Eliz. c. 25. The burning of woods, or under-wood, is declared to be felony; alſo thoſe perſons that maliciouſly cut or ſpoil timber-trees, or any fruit-trees, &c. ſhall be ſent to the houſe of correction, there to be kept three months, and whipt once a month.

WOOD-COCK, *Scolpoax*, in ornithology. See SCOLOPAX.

The wood-cock is a bird of paſſage, that comes into England about the middle of October, and goes away again in March. During their ſtay with us, they ramble about from place to place, never remaining above eight or ten days together in the ſame wood or meadow. They ſeldom or never fly in the day-time, unleſs diſturbed by men, or by ſome beaſt. In whatever places they are put up, they always fly to the thickeſt wood that lies near, and there hide themſelves under the ſturdieſt and the thickeſt trees, where they remain all day ſearching for earth-worms, and other food, under the fallen leaves.

When night comes, they go out of the woods, and generally reſort to watery places, where they may waſh their bills, fouled with the taking their prey, and thruſting into the earth; here they remain all the night, and, if there is tolerable ſhelter, they ſtay alſo the day under it; but when there wants this, they fly away to the woods in the morning. In their flight, they chooſe the ſhadieſt places, and will coaſt it away to a great diſtance in ſearch of the higheſt woods to retire to, that they may be the better ſecured, and there more defended from the annoyance of the wind. While they travel under ſhelter, they always fly low; but when they come to any glade to croſs, they mount to a conſiderable height; but, as ſoon as they have paſſed this, they ſink again.

They hate flying high, and they are afraid to fly among trees, becauſe, like the hare, they ſee but very badly ſtraight before them; and it is owing to this imperfection in their ſight, that they are ſo eaſily taken in nets ſpread in their places of reſort.

The draw-net, in countries which are very woody, is extremely profitable in this ſport, it being no uncommon thing to take ten or a dozen wood-cocks at a time in it.

The method of uſing it to advantage is this: there muſt be choſen a proper place in ſome thick wood, where theſe birds are found to reſort, and a place muſt be cleared for them, and for the net. Suppoſing the wood about three hundred paces long, in this caſe, towards the middle there muſt be cut a walk through it eight fathoms wide: near the end of this, two oppoſite trees are to be pitched upon, proper to ſupport the two ſides of the net; the boughs of theſe are to be all cleared away, and the nets faſtened by logs and pullies.

When the net is thus placed, the ſportſman muſt provide ſome covert in which he muſt ſtand concealed. This is eaſily made by half a dozen boughs of ever-green trees with their leaves; and the ſportſman, when he has ſtuck theſe down in the ground, and interwoven their boughs together, may either ſtand behind it, or ſit down on a bundle of dry fern, or any other ſuch matter. At three or four feet diſtance from this ſtand, towards the net, there is to be a ſtrong ſtake faſtened into the ground, and on this the lines of the net are to be faſtened when it is drawn up. When there comes a wood-cock, the net is to be let down as ſoon as ever he is taken, to entangle him the more, for, otherwiſe, in the ſtruggling he may chance to make his eſcape. The ſportſman is then to run up, and break a wing, and cruſh his head. The net is then to be refitted again as quick as poſſible; for when one is caught, there is great reaſon to ſuſpect that many more are coming the ſame way, which will be all loſt, if the ſportſman is ſlow at his work.

If a hare, or any other creature worth the taking, come along the walk, the net is not to be immediately let down upon it, for in that caſe it would certainly ſtart back, or run forwards, and in either caſe it would probably make its eſcape: the net is to be drawn up five or ſix feet, that he may paſs quietly under it without ſuſpicion; as ſoon as he is gone by, the ſportſman is to make a great ſhout, and let go the net; the creature will, on this noiſe, ſtart back, and will thus be certainly taken in the net.

There are in many places, great throughfares through ſome open piece of ground, by which woodcocks paſs in great numbers from one wood to another. If there be in theſe two trees, naturally planted, ſo as to ſuſtain the nets, they are by all means to be uſed; but, if not, the ſportſman will find it worth his while to be at the expence of planting two trees deep in the earth, at proper diſtances, that they may ſtand all weathers. Nets ſpread between theſe are the moſt fatal of all others to theſe birds, for all that inhabit either one or the other of the woods come this way at times, without ſuſpicion of any danger or diſturbance.

There is another method of taking theſe birds in high woods, with thoſe nets called hays, of the nature of the rabbet-hays, only with ſmaller meſhes. The woodcocks are driven only into theſe, and there ſhould always be at leaſt two or three of them planted together. When the ſportſman has provided himſelf with nets, he is to take five or ſix perſons into the wood with him. The proper woods for this purpoſe are thoſe of ſeven or eight years growth; and the people are to go into ſome part of them, near the middle. The nets or hays are to be placed in the ſame manner as they are for taking of rabbets, but two or three joining together at the end, and hanging over ſlopewiſe that way which the wood-cocks are intended to be driven.

The nets being thus fixed, let the company go to the end of the wood, placing themſelves at about ten rods diſtance from one another; they muſt all have ſticks in their hands, and they are to move forwards ſlowly towards the nets, making a noiſe by ſtriking the ſticks againſt the trees and branches, and by hallooing with their voices:

voices: in this manner they are to move up to the net; and the wood-cocks in that part of the wood will all be terrified before them, but will not take wing, but run along upon the ground, and thus be driven along like a drove of beaſts, ſo that, when the company come up, they will find almoſt all of them in the net. When that part of the wood is thus drove, the nets are to be turned the other way, and placed ſlopewiſe in the contrary direction, and the company, retiring to the other end of the wood, are to drive the woodcocks that are in that part with the ſame noiſe, till they have ſent them into the nets in the ſame manner.

Thus all the wood-cocks in the wood may be taken with very little trouble, and this may be done equally at any time of the day.

Another way of taking this bird is, by means of nooſes or ſprings.

The wood-cock and the ſnipe are both eaſily taken alſo with bird-lime, when their places of reſort are known, but they are not ſo eaſily found as many other birds.

The cuſtom of the woodcock is uſually to be upon the banks under hedges, and by the ſides of ditches towards the ſun; and they will ſuffer the ſportſman to come nearer them in the day-time after a moon-ſhiny night, than after a dark one. The reaſon of which is, that, having fed well by moon-light, they are only fit for reſt in the day following; but, when the night has been dark, they are ſeeking food all the day long.

The ſnipes naturally lie by the ſides of rivers, when the plaſhes and ponds are frozen, and they always lie with their heads up or down the ſtream, never tranſverſely.

In order to take either of theſe birds by bird-lime, the ſportſman muſt be provided with a large number of ſmall and ſmooth twigs, neatly and evenly covered with good bird-lime. Theſe muſt be placed ſloping, ſome one way, ſome another, and the whole place about where they reſort muſt be covered with them. The ſportſman then muſt conceal himſelf very carefully, that the ſight of him may not frighten away the game.

Woodcock Shell, in natural hiſtory, the variegated yellowiſh purpura, with tubercles, and a long beak; and the thorny woodcock ſhell is the yellow long beaked purpura, with long and crooked ſpines.

Wood-Corn, is ſaid to be corn given by the tenants of ſome manors to the lords for the liberty to gather up wood, and the feeding of cattle there.

Wood and Wood, in the ſea language, is when two pieces of timber are ſo let into each other, that the wood of the one joins cloſe to the other.

Wood-Land, in agriculture, a term uſed by the farmers of many counties of England, for a ſort of ſoil, from its conſtant humidity and dark colour, reſembling the ſoil in woods, which, of whatever nature it originally is, will always be made to appear thus from the continual dropping of trees, and the want of a free air and ſun, together with the fall of leaves, deſtroyed and waſhed to pieces by the wet.

This ſoil in the open countries has a conſiderable quantity of clay in it, and holds the water a long time that once falls upon it: in wet weather it ſticks firmly to the plough-ſhare, and, in dry, is very apt to crack. In uncultivated places it uſually produces ruſhes and ruſh-graſs. A moiſt and dripping year is extremely detrimental to this ſort of land.

Wood-Lark, in ornithology. This is one of the ſweeteſt of our ſinging-birds, and is indeed very little inferior to the nightingale, when in good health: for we are not to judge by ſuch as are made feeble by improper food, or want of cleanlineſs in their cages.

It is one of the tendereſt birds we have, and yet it breeds the ſooneſt of any that we know of. They principally frequent gravelly grounds, and the ſides of hills, that are expoſed full to the ſun; and, if there be any ſtumps of oaks in theſe places, they always reſort to them.

The females couple with the males in the beginning of February, at which time, and never before, they part with their laſt year's brood; immediately after coupling, they betake themſelves to building their neſt.

They generally build in lay, or grounds where the graſs is rank, and is grown brown. The principal material they uſe is dry graſs, and they always chuſe ſome place ſheltered by a good tuft for their neſt, to defend themſelves from the cold winds, which are very ſevere at that ſeaſon. They feed their young principally with a ſmall red worm; but it is very difficult to find this kind, to feed a neſt of them under our care, and they will not do well without it; ſo that they ſcarce ever come to any thing this way.

Wood-Mite, in natural hiſtory, the name of a little animal frequently made the ſubject of microſcopical obſervation, and by ſome called the wood-louſe; though that leſs properly, as there is another larger animal generally known by that name.

The wood-mite is in ſhape and colour very like a louſe, and is frequently found running very nimbly, but always by ſtarts and jumps, on old books and rotten wood. The eyes of this creature are of a fine gold colour, and can be thruſt out or drawn in at pleaſure; and when examined by the microſcope, the periſtaltic motion of the guts is ſeen very diſtinctly and beautifully; and, what is more wonderful, there is obſerved a very diſtinct and regular motion in the brain.

This probably is the ſame animal with the pediculus pulſatorius, deſcribed by Derham, as one of the death-watches. *Baker's Microſcope.*

Wood-Pecker, *Picus*, in natural hiſtory, a genus of birds, with the beak ſtraight, of a polyhedral or many-ſided figure, and with its point formed in the manner of a wedge; the tongue is rounded and very long, it reſembles in form a worm, or ſome other ſuch inſect; the toes, in all but one ſpecies, ſtand two before, and two behind, as in the parrot. This genus comprehends the great black wood-pecker, with a ſcarlet head, in ſize ſomewhat larger than that of a fieldfare; the green wood-pecker, with a ſcarlet crown; the great ſpotted wood-pecker, with a black head, and ſome of the tail-feathers white; the leſſer ſpotted wood-pecker, with three lateral rectrices, half black; the three-toed wood-pecker, with only three toes; the Braſilian wood-pecker, or ipecu, with a ſcarlet creſted head; and the golden wood-pecker, or the yellow picus. There are various other ſpecies of wood-peckers, as the brown picus, ſpotted with yellow; the black picus, with the wings and tail yellow, &c.

WOODWARD, an officer of the foreſt, whoſe function is to look after the woods, and obſerve any offences either in vert or in veniſon, committed within his charge, and to preſent the ſame; and in caſe any deer are found killed, or hurt, to inform the verderer thereof, and to preſent them at the next court of the foreſt.

WOOF, among manufacturers, the threads which the weavers ſhoot acroſs with an inſtrument called a ſhuttle.

The woof is of different matter, according to the piece to be wrought. In taffety, both woof and warp are ſilk. In mohairs, the woof is uſually wool and the warp ſilk. In ſattins, the warp is frequently flax, and the woof ſilk. See Warp and Weaving.

WOOL, *Lana*, the covering of ſheep; of which the manufacturers make divers kinds of ſtuffs, cloths, &c.

The wools moſt eſteemed are the Engliſh, chiefly thoſe about Leominſter, Cotswold, and the Iſle of Wight; the Spaniſh principally, about Segovia, and the French about Berry, which laſt are ſaid to have this peculiar property, that they will knot or bind with any other ſort, whereas the reſt will only knot with their own kind. Tavernier affirms, that the wools in Aſia, are incomparably finer than thoſe of Europe; and there is no doubt but that wool was the golden fleece ſought at Colchis. The wools of England have always been in the higheſt repute, eſpecially abroad. Spaniſh wools bear a great price among us, to work up with ours, the goodneſs of which is owing to a few ſheep ſent into Spain, as a preſent, by Henry II. though ſome ſay by Henry IV. in 1465.

The

The fineneſs and plenty of our wool is owing in a great meaſure to the ſhort ſweet graſs in many of our paſtures and downs; though the advantage of our ſheep's feeding on this graſs all the year, without being obliged to be ſhut up under cover during the winter, or to ſecure them from wolves at other times, contributes not a little to it.

Antiently, the principal commerce of the nation conſiſted in wool unmanufactured; which foreigners, eſpecially the French, Dutch, and Flemiſh, bought of us, inſomuch, that the cuſtoms paid on wool exported in the reign of Edward III. amounted, at 50 s. a pack, to 250,000 l. per annum. An immenſe ſum in thoſe days! But as wool is now accounted a ſtaple commodity, the employment of an infinite number of people at home, and our moſt beneficial trade abroad, depending upon it, very ſevere laws have been made to prevent its being exported, and perſons that export wool beyond the ſeas, are liable to a forfeiture of the ſhips or veſſels in which it is found, with treble the value, and the perſons aiding and aſſiſting in it ſhall ſuffer three years impriſonment. It is alſo enacted, that no ſheep ſhall be carried on board any ſhip with intent to be exported, upon forfeiture of 20s. for every ſheep; that the owners knowing thereof, are to forfeit their intereſt therein; that if they be aliens, or natural-born ſubjects not inhabiting this kingdom, ſuch ſhips ſhall be wholly forfeited; that the maſters and mariners knowing thereof, and aſſiſting therein, are to forfeit all their goods and chattels, and to ſuffer three months impriſonment; and that the exporter, beſides other penalties, ſhall be rendered incapable of ſuing for any debt, &c. As to the importation of wool, Iriſh wool, combed or uncombed, Spaniſh and Poliſh wool may be imported duty free.

WOOL is alſo uſed for the ſoft hair growing on ſeveral wild beaſts, the ſkins of which are diſtinguiſhed by the name of furs.

WOOLEN MANUFACTORY, includes the ſeveral ſorts of commodities into which wool is wrought.

The woolen manufactory makes the principal article in the foreign and domeſtic trade of Great Britain. It employs the chief of the hands on ſhore, in its different parts; loads their ſhips, and brings into the nation the immenſe riches for which our nation is, at preſent, ſo remarkably famous.

This ſtaple, however, did not fix itſelf on this iſland, till about the year 1420, when the art of making woollen cloths was imported from Flanders and Brabant, whoſe artiſts in that commodity, being driven from their native countries by oppreſſive taxes, and the ſeverities uſed in collecting them, took refuge in England. The government ſpared no endeavours to preſerve ſo valuable an acquiſition; but we do not find our nation arrive at any conſiderable perfection in the woollen manufacture, till the troubles about religion, occaſioned by the cruelty of the duke of Alva, and the Spaniſh inquiſition introduced into the Low-Countries, entirely ruined thoſe woollen manufacturers who had ſettled there, and greatly interfered with the trade eſtabliſhed in England. At this time the Dutch artiſts alſo joined us, and ſettled ſeveral great manufactures at Norwich, Colcheſter, Sandwich, Hampton, as well as at London, &c. And from that time this trade throve ſo prodigiouſly, that Dr. Davenant and Mr. King compute the product thereof in their time, when it was not at the height it is now brought to, to be eight millions ſterling, per annum: three-fourths of which, ſay they, are conſumed at home, and the reſt abroad.

Method of weaving, thickening, fulling, &c. Cloth. Before the warp is mounted, the threads are ſtiffened with a ſize made of ſhreds of parchment, or gum-water; when dry, the weavers mount their looms in the following manner: in thoſe places where the moſt beautiful thin ſtuffs are made, it is the common cuſtom to place eighteen threads upon the pegs of the loom. The going back over all the pegs, and the bringing back and return of them, on all the ſame again, produce the firſt aſſemblage of thirty-ſix threads, which is called a handful. And forty of theſe are required to compleat that bundle which is termed a chain. So that a chain, in weaving, contains 1440 threads, which multiplied by 12 ells, the uſual length of each thread, the ſum will be 17280 ells of thread. Then the artiſt, to render this bundle of long thread manageable and portable, rounds the ends thereof into a great loop, through which he thruſts his arm, and carries on it the bundle of threads. Then he makes a ſecond, and as many more links on it as convenient. And hence the long aſſemblages of warp threads, looped up, and ſhortened into a ſmall compaſs, take the name of the chain; a name they afterwards retain, even when extended on the loom to receive the croſs thread or woof. But ſeveral of theſe chains muſt go to form the mounting of a ſtuff, or that firſt baſis of long threads which are extended, parallel, from one end of the loom to the other. They are there received and rolled upon the beam: and as faſt as they are converted into ſtuff, or cloth, by the throwing in of the woof, the ſtuff or cloth is rolled upon the other wooden cylinder that lies before the workman under the play of the ſhuttle.

The warp being on the loom, the weavers, who are employed in broad works, attend two to each loom, one on each ſide, and tread at the ſame time alternately, on the ſame treddle, that is, now on the right ſtep, and now on the left, which raiſes and lowers the threads of the warp equally; between which they throw tranſverſely, the ſhuttle from one to the other: and each time that a ſhuttle is thrown, and ſo a thread of the woof inſerted within the warp, they ſtrike it conjointly with the ſame frame wherein is faſtened the comb, or reed, between whoſe teeth the threads of the warp are paſſed; repeating the ſtroke as often as is neceſſary, ſometimes no leſs than twelve, or thirteen times, viz. ſix with the warp open, and ſeven with it ſhut. The cloſer the threads of the woof are ſtruck againſt each other, the cloſer the cloth will be; and better enabled to bear the violence of the fulling-mill, as well as of the teazel and fulling-thiſtle, without opening or fretting. When the whole warp is filled, the cloth is finiſhed: and it is taken from the loom by unrolling it from the beam whereon it had been rolled, in proportion as it was wove; and now given to be cleared of the knots, ends of threads, ſtraws, and other filth; which is done with little iron nippers.

When a ſtuff or cloth is intended to be thickened, and to be more or leſs nappy, it is carried to the fulling-mill to thicken its warp, by ſtrongly preſſing the hairs of the woof, which are always found, in ſome degree, after weaving, be the wool never ſo fine; and being faſtened within the body of the ſtuff, ſtand with their ſharp end outwards.—It is the fuller, who, properly ſpeaking, gives the cloths their real ſubſtance: his art being to add the advantage of felting to the regularity of weaving, and to cleanſe the ſtuff perfectly. None but cloths require the firſt operation; all cloths and ſtuffs require the latter. The firſt is performed by a mill, in which the cloths are beaten by hammers, while the water runs continually over them, till they are reduced to their proper breadth, and thoroughly cleanſed from all impurities. The ſecond is no more than a dry beating, after the ſtuff has been judiciouſly ſmeared with fullers-earth, which is an abſorbent matter, proper to extract all the unctuous juices: and, as occaſion ſerves, they waſh the moſt tenacious particles away with clear water. By repeating this ſeveral times, the moſt dirty cloths and ſtuffs are cleanſed from the earth, oil, impurities of dyeing, &c.

Beſides the variety which proceeds from the choice, the mixture, the preparation and working of the materials, the manufacture may be further diverſified by finiſhing or not finiſhing it in this or that manner, after the goods are really made. For they change their names, according to the manner, in which they paſs through the hands of the fuller, and are ornamented or dreſſed.

Firſt it is knotted, or rather cleared from all its knots, little ſtraws, and exuberances, by the help of ſheers and birchen whiſks; for if the leaſt hard body ſhould be left upon a cloth or piece of ſtuff, it would, in great likelihood, make a hole, while in the fuller's ſtock or pot; from whoſe hand it returns again to the knotter, who carefully turns it over a ſecond time, and with great exactneſs picks out all the earthy, and other ſubſtances,

that remain, or had been overlooked, and might alter the colour, or otherwiſe damage the goods.

After this ſecond examination, the cloth or ſtuff is ſent again to the fulling-houſe, where it is perfectly cleanſed with hot water and ſope. When the water runs out of the ſtock as clear as it went in, then they leave off watering it to beat it dry. If the ſtuff or cloth has been felted or milled, they take care to unfold it every two hours, and pull it by its edges, as well to get out the creaſes contracted in the mill, as to prevent its too great ſhrinking; and, after that, waſh it once more in fair water.

The next operation is that of carding, thiſtling, or teazling the goods. A teazle, by ſome called a thiſtle, is a kind of wire bruſh, not unlike the head of a thiſtle, with an iron handle; every point of which terminates in a very ſharp hook.—In this work they moiſten the ſtuff well with pure water, ſpread it out, or hang it on a pole, and then raiſe the hair with this inſtrument; and fetch out the hair by rubbing it ſeveral ways from bottom to top, then from top to bottom, both with and againſt the hair: firſt with a dead thiſtle; or one that has been uſed before, and afterwards with a live thiſtle, or one that is entirely new; firſt with gentle ſtrokes, and then briſker; always taking care not to make the ſtuff ſwag, and to give it a nap, without weakening the ſubſtance, by adorning the outſide.

This work renders the ſtuff warmer, and more beautiful: but then it muſt undergo the ſheerer's ſciſſars; who corrects the inequality of the hairs raiſed by the teazle, and returns it to the carder. He cards it again very carefully, and remits it, for a ſecond inſpection, to the ſheerer; who now gives it at firſt a rough ſheering, and then finiſhes it both inſide and outſide in the exacteſt manner, according to his art.

As the cloth cannot be ſuppoſed to paſs through ſo many, and ſome of them dangerous operations, without being ſubject to ſeveral accidents from the teazle, &c. it is, when perfectly dry, ſent to the fine-drawer to mend the holes, and to ſtrengthen the weak parts, ſo as the moſt curious eye cannot diſcover them: and then committed to the tenter, which is a long frame of wood with rows of hooks quite round it, and of a width and length of the longeſt and wideſt piece of cloth. This frame ſtands upright, and is ſo contrived, that the parts of it are moveable, and can be pulled backwards and forwards at pleaſure. The uſe of this is to get out all the creaſes which the ſtuff has contracted in the fulling-trough, to keep it on the ſquare, and to bring it, without violence, to its proper ſize: and, finally, to put it in a condition, either to be better bruſhed and more gloſſy, or to be folded in ſquare folds, amongſt honeſt dealers. Whereas a too violent ſtretching upon the tenter undoes all the fulling-work, and looſes and weakens the cloth; leaving it ſwaggy, limber, and without ſubſtance: ſo that the legiſlature has been obliged to interpoſe their authority, and declare every piece of ſtuff forfeited, which has been lengthened on the tenter, more than half an ell in twenty; or ſtretched above a nail in width more than it was before. This fraud is detected by wetting a piece of cloth, when taken off the tenters, which will bring it immediately to its natural ſize.

When the cloth has continued its proper time on the tenter it is then bruſhed again, and always in the ſame direction, that the nap may lie all the ſame way. And the gloſs and uniform inclination of the nap is accompliſhed principally by the means of a tool, called a jack, made of a deal board. This jack is laid over with maſtic, roſin, powder of free-ſtone, and ſifted filings, on the ſide that touches the ſtuff; which compoſition attracts and clears the ſtuff or cloth of every little ſtraw, hair, and parings of the ſheers, that happen to remain unobſerved after the former proceſs.

But to finiſh its luſtre, the cloth muſt now be ſent to the hot-preſſer, who folds the cloth or ſtuff in ſquare folds; and ſometimes ſprinkles each fold with gum-water; and always interleaves each fold with paſte-boad, or very thick cartridge paper; covering the laſt fold with a ſquare board, to ſecure the goods from the preſs, under which they lie for ſome time, till the heat has gradually exhauſted all the ſuperfluous moiſture, and all the hairs which point upwards are deprived of their ſpringineſs: otherwiſe, the firſt drop of rain which ſhould fall upon the ſtuff, would, when it was dried away, reſtore to the hairs it wetted ſome kind of elaſticity, and make that ſeem a ſtain, which is really nothing but a reflection of light different from that of the hairs which are round about it, and have not been wetted. And to prevent this miſchief, they endeavour to make the preſs touch every-where alike: they repeat the interleaving, and ſometimes, in fine cloths, ſupply the firſt leaves with others finer and ſleeker; and, at ſome diſtance from each other, they add plates of wood or braſs made very hot.

This work uſed formerly to be performed by rolling the ſtuffs and cloths round the cylinders of a calender, and making them paſs, by the help of a turning beam, between an immoveable table of marble or hard wood, and another table very well poliſhed, or covered with a large ſheet of copper, backwards and forwards on the rollers, with a weight of 18 or 20,000 pounds weight.

Nor would we have it imagined that all this pains and charge, to give the woollen manufactures a gloſs, are intended only with a view to give them an uſeleſs luſtre, or to impoſe on the chapman by a brilliancy, which will ſoon fly off; but to give them a permanent beauty, and to add to them a real value: for experience teacheth that a cloth, which has not gone through theſe operations, never wears ſo well, nor gives ſo much ſatisfaction to the purchaſer; it has the appearance of a very hair-cloth, without any equality in its grain, or exactneſs in its colour. The unequal tenſion of the two threads, which mutually croſs each other, and the accidental diverſity of ſtiffneſs and ſuppleneſs, which may happen to every part of the ſtuff, and even to each little fibril, neceſſarily diſpoſe the whole piece to crack and pucker up: and this would be unavoidable, eſpecially to ſlight ſtuffs, without the ingenious precautions of the dreſſers and preſſers.

The ſtuffs and ſerges, whether thoſe which, being very ſleek, do not go to the fulling-mill; or thoſe, which have been only beaten with water: or, laſtly, ſuch as have been beaten dry, as well as wet, in order for napping, ſhould all be rinſed and expoſed to the air. They are taken off the poles to give them the laſt finiſhing; the principal deſign of which is, as obſerved before, to deſtroy entirely any remaining ſpringineſs or ſtarting, which may interrupt the equality of the texture; to incline all the hairs on one ſide of the piece in the ſame direction, that a right ſide may be formed; and to produce a kind of harmony through the whole piece, by rectifying all diſorderly tenſion of the fibres within the ſtuff, and by the uniformity of its reflections of the light from without. This is performed in very thin ſtuffs by ſtretching them in a proper manner, each ſeparately on a little roll, and laying all the rolls together in a large ſquare copper kettle, on a board full of holes, which is raiſed to ſome diſtance from the bottom of the kettle under this board; in the kettle, is a quantity of water, which being heated, and the kettle cloſe covered, the ſteam that riſes is neceſſarily reflected by the cover, and returned back from all ſides upon the ſtuffs, and getting into them by little and little, it ſupples all the hairs that have too much ſtiffneſs and elaſticity. The preſs will do the reſt.

But all fulled ſtuffs are ſprinkled over the wrong ſide, firſt with gum-water, and, after extenſion on a large roller, to get out all the creaſes and inequalities, they are rolled off ſlowly upon a bar of poliſhed iron, which ſupports the piece in that ſtate over a large chafing-diſh, capable, by its heat, to put the leaſt fibre in motion; and from thence it is carried upon another roller, which draws it even by the help of a wheel or engine for that purpoſe. And thus the ſtuff is returned from one to another, at the diſcretion of the workmen: and this is called dreſſing or calendering.

In order to ſet this uſeful mechanic invention in a true light, we ſhall add here the moſt uſual terms uſed therein, ranged in the ſame order as the various operations are performed.

The wool is waſhed; either in heaps, in ſtanding water; or in the coyriddle, in running water; or in tubs full of river water.

To prepare the bath or ſuds, is to let the wool ſoak in water, until it has thickened the water in the tub, by diſcharging its greaſineſs and ſalt in it. Thence it is, that inſects ſeek clean wool, and will not touch that which retains its natural moiſture.

Wool in the greaſe, is that which ſtill preſerves its natural greaſineſs. This is better for keeping, becauſe the moth will not get into it.

A waſhing of wool, is a heap of wool, taken out of the tub, and ſet to drain in the air.

To waſh the wool alive, is to waſh it on the ſheep's back before ſhearing.

The ſhears are ſciſſars made of one piece of ſteel, which forms the bow and two blades. The bow is a ſemicircle, from whence the two blades ſtretch forwards. Theſe are preſſed cloſe to each other, and cut the wool under the workman's fingers, and then fly back by the ſpring of the bow.

A tod of wool is what is cut off the ſkin of the ſheep, beginning at the legs and ending at the head.

A fleece is the tod gathered up into a packet. Out of trade, a fleece ſometimes ſignifies a ſheep-ſkin with the wool on.

The puſhes are wool finer than the reſt, which ſhoot out by little tufts in different places. They are plucked off the ſheep before ſhearing. In the province of Berry this laſt name is given to the wool taken off the thighs.

The breechings are thoſe which are ſo hard and clotted, that they are of the conſiſtence of felt. They are alſo called clottings, becauſe the beaſt, eſpecially when ſick, dirts and clots them by lying much on one ſide.

Pelled wool is that which comes off from ſcabby ſheep.

Sprazely or crudley wool is the young hungry wool which ſhoots out before the old is ſhorn.

Locks or breechings are long white hairs, as ſtiff as badger's hair.

All theſe ſorts of wool are bad or rejected. Yet it cannot be ſaid that they ought to be thrown away as uſeleſs. They are uſed in very coarſe works, ſuch as ordinary rugs.

Clipping is cutting off the coarſe ends of the wool, before it is waſhed. Thoſe ends are called locks.

The fleece wool is that which hath been ſhorn off the ſheep while alive.

The lambs wool is the wool cut off lambs.

The glovers wool is the wool, which the leather-dreſſer takes off the ſkin, after the ſheep is killed.

The fell wool is the wool ſtripped off ſheep which died of ſome diſtemper. The uſe of this ſort is prohibited.

In ſorting Segovia wool, it is diſtinguiſhed into firſt, ſecond, and third. The ſame order is obſerved in ſorting Spaniſh wool.

As to other ſorts of wool, the only diſtinction that is made, is into the high wool, which is the longeſt, and is generally reſerved for combing; and the low wool, which is uſually carded. However the long wool, when it is to make cloth, is alſo carded, becauſe it does better ſo than when combed.

Fine wool unſcoured, is only fit for the market, and not for working. In order to work it, in ſome caſes they begin by waſhing and combing it; in others by getting out the greaſe by boiling, in order to waſh and comb it afterwards; and there are other caſes ſtill, in which it is firſt dyed, then carried to the river, and thence to the comber.

The ſcouring boiler, or copper, has a croſs bar in it, to ſupport the wool taken out of the water. There are alſo poles to ſtir the wool, peſtles to pound or beat it, hooks to draw it out, baſkets to hold and carry it to the river, where the cleaning of it is finiſhed.

Common wool, which has been waſhed on the ſheep's back, ought, before working, to be carefully examined, picked off the locks or clipped, and cleaned of all refuſe,

In ſome manufactories wool is wrought white, in others it is dyed before working.

For dying wool the ſame utenſils are requiſite as for ſcouring.

The ingredients are the preparatory and colouring materials.

Setting the copper, is to put the neceſſary ingredients into it.

Handling the wool is to open it, by ſtirring it with the poles, in order to make every part of it take the colour equally.

Increaſing the boiling is to enlarge the fire.

Cooling the wool is to ſpread it out in the air.

If the wool has been only grounded or galled; that is, if it has only had its firſt dip, or the firſt tincture of galls, copperas, or other ingredients, whether preparatory or colouring; then it muſt be brought in from the airing to the copper, to be there revived by a ſecond dip, which brightens the dye, or to be lowered by a new mixture, which either diminiſhes its luſtre, or gives it another teint; or in fine to give it a deeper caſt of the ſame colour.

To beat the wool, whether dyed or white, is to ſpread it on a hurdle, and to open its texture by whipping it with ſwitches, in order to make it fit for combing, or carding, and ſpinning.

For combing wool they uſe

A little furnace, which ſerves to warm the combs.

A vice and hook to fix the combs.

A pair of combs, which are two little boards, almoſt ſquare, ſtuck with teeth of iron wire, ſome a little longer than others.

Each comb has its handle.

A hammer, to put in and take out theſe teeth.

A braſs hollow tube, to mend them when out of order.

A file, to point them when blunt.

A windlaſs, to twiſt the wool ſoaked in ſoaped water, before it be put on the comb.

A tub, in which the ſoap is diſſolved.

To comb in water, is to comb the wool that has been ſprinkled with oil, in order to waſh it afterwards.

A certain quantity of wool is given by weight to the workman.

A beating, is a parcel of wool beaten on the hurdle.

A ſliver is a proper quantity of wool put into the teeth of the comb.

To diſcharge it, is to take out the ſliver, after having moved the right comb backwards and forwards on the left, and the left on the right.

The carding is the quantity of wool that ſticks to each comb, and is ſufficiently combed after a certain number of movements of one comb on the other. There are always two cardings, as well as two combs.

A diſtaff is two cardings joined together, which make up a ſufficient quantity for the diſtaff.

The ſhort wool, which cannot be wrought together by combing, is not loſt. It goes to the card.

To brimſtone the wool, is to ſuſpend the ſeveral ſkeins over the brimſtone room.

The brimſtone ſtove is a little ſtove well cloſed and cemented at top, to whiten the wool by the fumes of brimſtone burning in a pan.

When dyed wool is combed, they begin by mixing it according to the taſte and ſkill of the maſter-worker.

The different colours are effaced by the judgment in mixing them, whereby there reſults a new colour.

The comber follows a certain rule in the quantity of each colour he takes for each combing: on which depends the uniformity of the colour required.

Carded wool is broke in a different manner from combed wool. It paſſes through two tools called cards, which are two little quadrangular pieces of board, three or four times as broad as tall, with a handle to each, and thick ſet with ſmall crooked wires. The cards are changed, beginning by the wideſt, and ending with the cloſeſt, in order to break the wool, and mix the colours the better.

Spinning is of two ſorts.

Twiſted thread is ſpun by the ſpindle or little reel, from combed wool, and ſerves for the chain or warp,

which

which is the ground of little ſtuffs. The name of chain, or warp, is alſo given to the threads running lengthwiſe in a piece of cloth, and which make the ground of it.

The ſlack ſpun is made by the great wheel from carded wool, and is called the wool, or ſhute. The wool croſſes the threads of the warp, and may be called ſhute with regard to a ſtuff that has a pile.

The thread of the work in cloths, is generally called back-thrown, becauſe being made from carded wool as well as the woof, it is likewiſe ſpun by the great wheel, but with the circumſtance of croſſing the wheel-ſtring: which has a double good effect, viz. to make a thread ſomewhat better twiſted and ſtronger, and to give it a different twiſt from that of the woof; whereby they thicken better in the fulling mill.

Stuffs may be divided into three ſorts, tammy, ſerge, and cloth.

Tammy or ſtuffs of two tammies, are made of thread of warp upon thread of warp, that is, the warp is of twiſted thread, and the woof of the ſame, both made from combed wool.

Serge is made of ſlack ſpun, or carded wool, on a warp of tammy, or combed wool.

Cloth is made of two ſoft threads, that is, both the warp and woof are of thread ſpun from carded wool, and very little twiſted, in order to make a more ſubſtantial and wooly ſtuff.

Theſe three fundamental ſorts are ſubdivided into a vaſt number of others, according to certain qualities added to them, and different ways of working.

To weave, is to work at the loom, or to make ſtuff.

One weaver is ſufficient for making tammy and ſerge; becauſe as theſe little ſtuffs are not wide, the ſame workman can throw his ſhuttle with his right hand between the threads of the warp, and receive it with his left, in order to throw it the contrary way. But cloths and blankets, being very wide, are wrought by two weavers, one of whom throws the ſhuttle, the other receives and throws it back; and they go on thus alternately with as much regularity, as if the work was done by the two hands of the ſame man.

The loom is compoſed of ſeveral parts, whereof the chief are the loom-poſts and croſs-bars.

The three rolls or rollers, viz. the little one, the knee-roll, and the cane-roll.

The warp is at firſt faſtened at one end of the loom on the leaſt of theſe rollers, and at the other end is rolled on the ſecond cylinder, which is thicker, and is called the cane-roll: according as the warp is filled with woof, the ſtuff is to be rolled under the loom on the knee-roll; and at the ſame time the ſame length of the thread of the warp is unrolled off the cane-roll, as that of the ſtuff rolled on the knee-roll.

The batten is a large moveable frame ſuſpended on two pins at the top of the loom, to move freely backwards and forwards, under the workman's hand, who, after every throw of the ſhuttle or thread of the woof, ſtrikes in this thread more or leſs with the batten and reed.

The reed or comb is made of two rods, with a long row of teeth of reeds, or braſs wire. It is placed at the lower part of the batten. Every thread of the warp paſſes ſingly between two teeth of the reed: that ſo the batten may move without breaking the threads, and ſtrike in the woof equally, without leaving any part of it irregular.

The lams are behind the reed. Each lam is compoſed of two virgees or laths, whoſe length ſhould be the width of the ſtuff, and of little ſtrings ſtretched from one virgee to the other, which are called leiſhes. In the middle of each leiſh there is a loop or little ring of thread, horn, or glaſs, to receive one of the threads of the warp. Thoſe threads of the warp, which paſs through the loops of one lam, paſs between the leiſhes or threads of the other lam; and thoſe which paſs through the loops of the ſecond lam, play freely between the threads of the firſt; ſo as to be able to deſcend, while the firſt aſcends: and thus theſe two lams being near their ends faſtened to a common cord paſſed round a pulley at top, and at bottom to another cord which ſupports a treddle, lying under the workman's feet; if he lowers the fore lam with his left foot, the other lam muſt riſe up. The reverſe happens upon a contrary motion. If there are a greater number of lams to vary or figure the ſtuff, certain parcels of threads are thus raiſed and lowered at a time, whereby divers openings are made to receive the throw of the ſhuttle. As often as the foot is changed, and the warp receives a new throw of the woof, the batten cloſes it more or leſs according to the quality of the ſtuff. When the increaſe of the ſtuff hinders the play of the batten, there is as much of the warp rolled off the cane-roll, as of the ſtuff rolled on the lower great cylinder. Concerning the manner of guiding the threads of the warp through the rings of the jack on the warping mill; of managing the ſeparation of the threads of the portee; of uniting ſeveral portees in one chain; and of making one entire warp of them all; of bruſhing or moiſtening it with ſize, to make the threads glide eaſier in working; of mounting it on the loom, by faſtening it in a groove of the little roller; of paſſing the threads in good order through the teeth of the reed, and then dividing the ſame threads, and making ſome of them go through the loops of one lam, and between the leiſhes of the next; and others between the leiſhes of the firſt, and through the loops of the ſecond; of fixing and maintaining the diviſions of the threads, by the inſertions of ſeveral rods which prevent their mixing; of facilitating, in fine, the unwinding and play of the warp and woof by the uſual precautions and proper tools; theſe operations are eaſily comprehended at firſt ſight: but their number is ſo great, that if the workmen did not uſe great diſpatch, by every one conſtantly plying to his own part; ſheep's wool either would never be converted into cloathing, or would bear too high a price for the common people. Let us not remain unacquainted with what ſhews the greateſt induſtry, after the play of the lams.

The ſhuttle is a piece of hard wood, that runs tapering to a point at both ends, and has a cavity in the middle, called the box or chamber, for receiving the quills.

The quill is a ſmall pipe of reed, on which a proper quantity of the thread of the woof has been wound, and which plays on the ſhuttle pin.

The ſhuttle pin is an iron wire, which runs through the quill, and with it is ſet in the chamber of the ſhuttle. It is put in, ſecured, and taken out, by the different action of a ſpring at the end of the chamber, where the ſhuttle pin is placed.

As the ſhuttle runs through the warp, the thread of the woof, which ſlips through a hole or eye in the ſide of the ſhuttle, and has been faſtened to the lizier, muſt run off the quill, which runs round as the ſhuttle goes on. When this quill is emptied, another is put in its place; and the ends of the thread of the two quills are laid cloſe to one another without knotting; only taking care to manage the throw of the ſhuttle, ſo as to be ſure of keeping both theſe ends of the woof together.

The heads of the piece are ſome few inches of the ſtuff, made with a different ſort of woof from the reſt. The names of the workmen and place are wrought in it: and afterwards the lead-ſeals are put to it, which are a teſtimony of its being examined and found to be of good materials, and of the breadth and quality required by the laws for the reſpective ſorts.

The temple is compoſed of two flat notched rulers, ſecured one over another by a ſliding ring, and having pins points at their ends. The workman faſtens the two ends, full of points or ſpikes, to the two liziers, or liſts, which are the outer threads of the width of the ſtuff; and, by bringing the virgers or laths more or leſs forward, he keeps the ſtuff conſtantly of an equal breadth. If he did not take care to temple his ſtuff, the woof would ſhrink unequally, and bring the threads of the warp nearer together in ſome places, and in others farther aſunder. But by removing his temple from time to time, to keep it near the laſt throws of the woof, he ſtrikes the woof in upon a ſquare, and ſo as to make it receive the ſtroke of the batten equally in every part.

The workman continues to throw the ſhuttle, to temple, and to wind off alternately. When he is come to the end of the piece, he takes another ſort of thread for the woof, as he had done at beginning it, and makes a ſtripe of a different colour, for the names and ſeals, as above. Theſe two ends are called the head and the fag-end.

To ſteam a little ſtuff, as is done at Amiens, Rheims, and La Mans, is to render it ſupple, by expoſing it to the ſteam of boiling water in a ſquare kettle or copper, where it is laid, ſtill on its roller, with other pieces. This operation diſpoſes it for dreſſing well.

The fullery is a water-mill for working great mallets on ſtuffs, either to clean them, or thicken them to the conſiſtence of felt. See the article FULLING.

The ſtocks, or fuller's pots, are hollow veſſels to hold the ſtuffs, which are continually turned under the ſtrokes of the mallets.

The levers, or prominent bars, are the ends of pieces of timber, that run through the axle-tree or arbor of the wheel, and which, as they paſs, catch the heads of the mallets, raiſe them up, and let them fall as they go off.

To earth the ſtuff, is to rub it with fuller's earth.

To beat it in the earth, is to full the ſtuff with the earth on it, letting a water-cock run on it at the ſame time.

To ſcour cloth, is to full it after ſoaping it with black ſoap, which carries off all ſpots.

To clean-ſtuff, is to full it with a great deal of water, to carry off any remains of dirt, and to rinſe it.

To beat it dry, is to full it without water, till it has acquired the utmoſt thickneſs it is capable of, and beyond which it runs into a pap.

When ſtuffs come from the fulling-mill, they are aired, that is, hung out.

The pieces brought from off the poles or tenters, ought to be made up, that is, properly folded on a table; then gummed at every fold, by ſprinkling the backſide with a ſolution of gum arabic in water.

To ſtretch the ſtuff, is to paſs it from one roller on another, keeping it conſtantly of the ſame breadth, over a braſier, by means of an iron bar, on which it ſlides; whereby the heat penetrates, and breaks its ſtiffneſs. And, by thus paſſing ſeveral times from one roller on another, it is rendered pliant in every part alike.

There are ſome ſtuffs that are unrolled and rolled without fire. But it is always allowed to ſuch as are to be dreſſed very well.

The effects of this ſtretching are, firſt, to ſmooth or take out the bad folds; ſecondly, to gum the whole piece equally by the fire's ſpreading the moiſture everywhere, which evaporates, and leaves the gum behind. Thirdly, to ſtretch the whole in an uniform manner: which is of vaſt conſequence in the wear of ſtuffs.

They are folded near a good fire.

They are leafed, by putting a leaf of paſteboard hot, between every two folds.

They are put between two thick boards of box, which take in the whole pile of folds.

They are left ten or twelve hours in a ſtrong preſs: and this is repeated three or four times.

They are viſited for the laſt time, and after drawing out the two ends, called the head and fag-end, the lead-ſeals, tickets, and other marks are put on which denote the quality, breadth, length, dye, and other things preſcribed by the laws: then they are put into the preſs again, and ſtitched, by ſecuring the folds looſely with threads run through the liziers.

There are ſome other practices peculiar to different manufactories; but they all tend to the ſame end.

Cloth is not ſtretched on the rollers; but, after having been fulled, teazled, tentered, or hung on the rack, ſhorn twice, cottoned, and the pile laid ſmooth one way, it is gummed or folded on leaves, put to the preſs, the leaves are changed, and, inſtead of thick coarſe paſteboards, others thinner and ſmoother, called cards, are put between the folds: it returns to the preſs, or elſe to the calender, which gives it its laſt gloſs. *Spectacle de la Nature, Tome VI.*

Explanation of the Plates repreſenting the moſt material operations of the Woollen-Manufacture.

Plate CXLI. Waſhing the wool.

Fig. 1. A, the tub in which the wool is waſhed.
B, the workman waſhing the wool.
C, the wool in the tub.

Fig. 1. N°. 2, D, part of a river in which the wool is rinſed, and cleanſed.

E, a coyriddle containing the wool to be rinſed.

F, the workman performing the operation.

G, a portable board, reſting on piles, on which the workman is ſupported.

Fig. 2. two workmen employed in ſtirring the wool.
A, the tub.
B, B, the ſtaves with which the workmen ſtir the wool.

Fig. 3. Horſes for drying the wool after it is cleanſed.

A, A, &c. B, B, &c. poles charged with waſhed wool.

Plate CXLII. Picking and beating the wool.

Fig. 4. A workman employed in picking the wool.
A, the hurdle, on which the wool is placed.
B, the wool.
C, the picker.

Fig. 5. Two men employed in beating the wool upon a hurdle.
A, the hurdle on which the wool is placed.
B, B, the workmen beating it.

Fig. 6. The cards, &c. for carding the wool.
A, B, the horſe for ſupporting one of the cards.
e, the card fixed on the horſe.
D, the other card, ſeen on its upper ſide.
f, a box for holding the wool.

Fig. 7. *b*. the great cards.

Plate CXLIII.

Fig. 8. *c*, *c*, the little cards.

Spinning the wool.

Fig. 9. N°. 1, and 2. The great ſpinning-wheel.
A, the form or ſupport of the wheel.
b, *b*, the ſupporters of the broche.
C, the large wheel.
D, the arbor of the large wheel.
e, the reed, on which the thread is wound in a conical form.
f, the head of the reed on which the thread is wound.
g, the arbor on which the reed is faſtened.
h, the pulley, round which the ſtring of the large wheel paſſes.
H, the poſt which ſupports the large wheel.

Meaſuring of the thread.

Fig. 10. and 11, the reel for winding and meaſuring the thread.
A, the form of the reel.
b, *b*, *b*, poſts or ſupports of the reel.
c, *c*, *c*, *c*, arms of the meaſuring reel.
d, *d*, arbor.
e, pinion of the arbor.
D, the toothed wheel in which the pinion of the arbor moves.
F, the wheel carried by the pinion of the arbor.
G, the hammer.
h, pinion fixed on the arbor of the wheel F.
i, thread wound upon the wheel F.
k, a weight, keeping the thread tight.
l, a ſmall anvil, on which the hammer ſtrikes at proper intervals.

Forming the chains.

Fig. 12. A workman forming a chain.
A, the tub.
B, B, the chain.
C, the paſte.
D, the workman.

Fig.

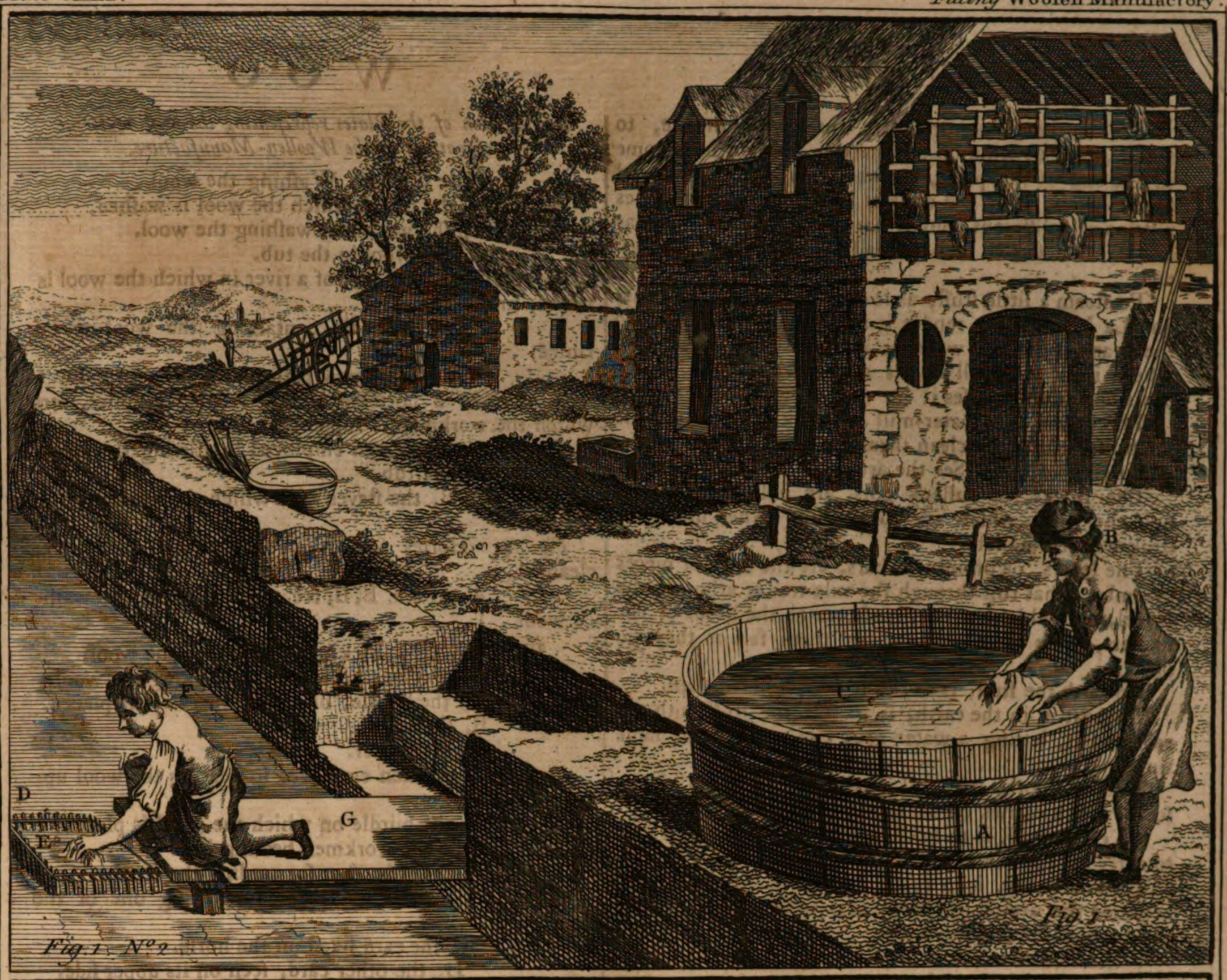
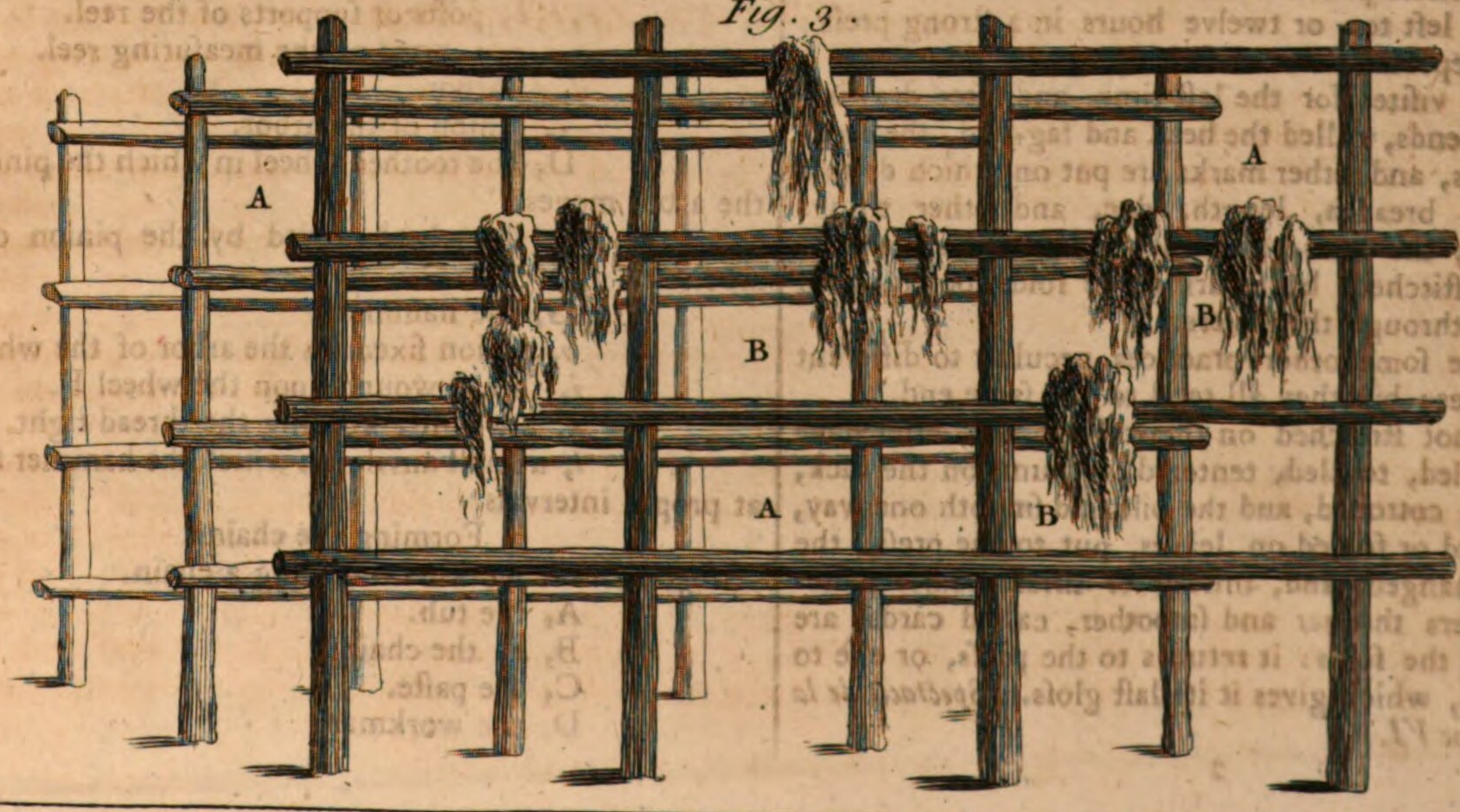


Fig. 2.



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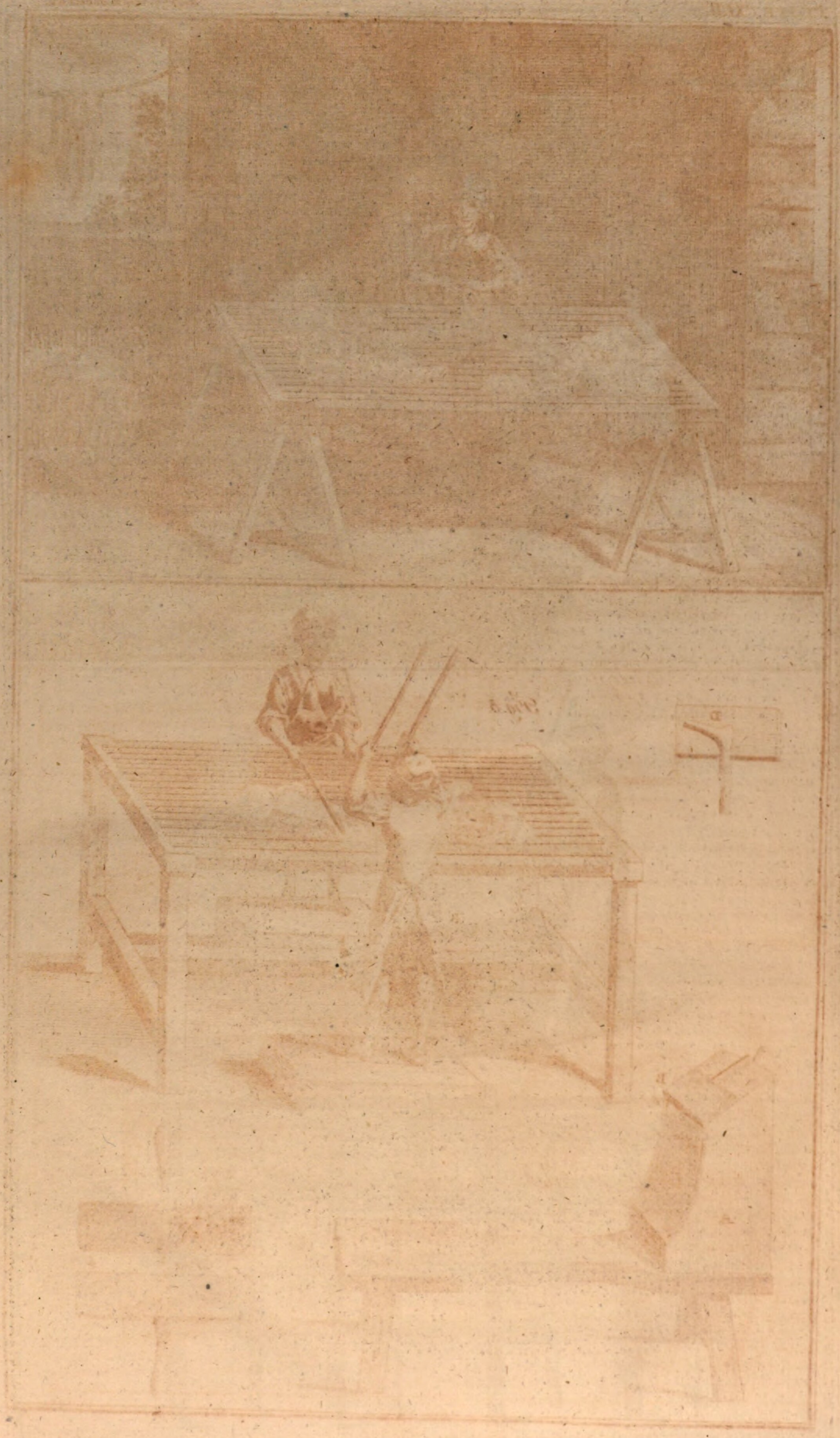

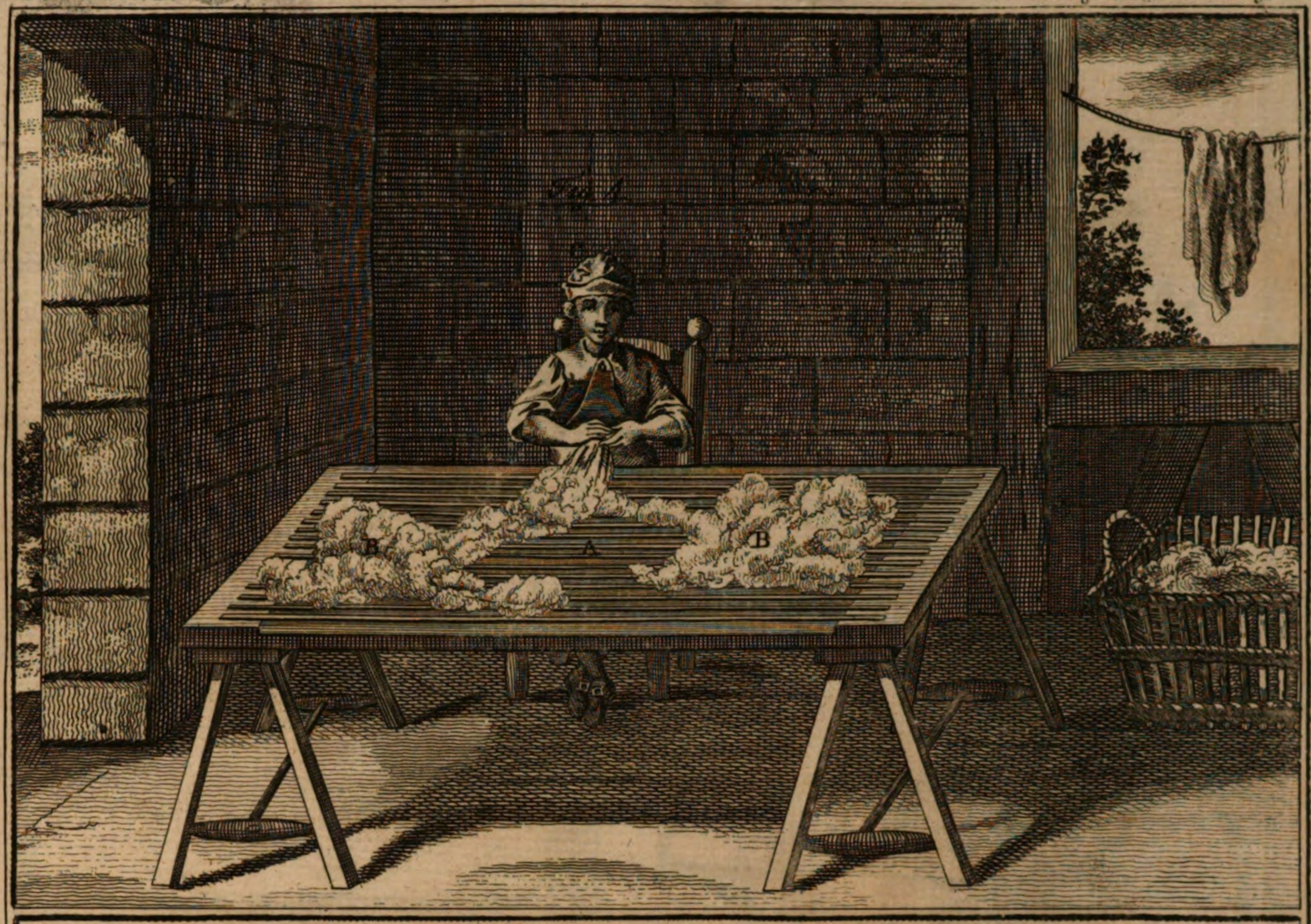
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A
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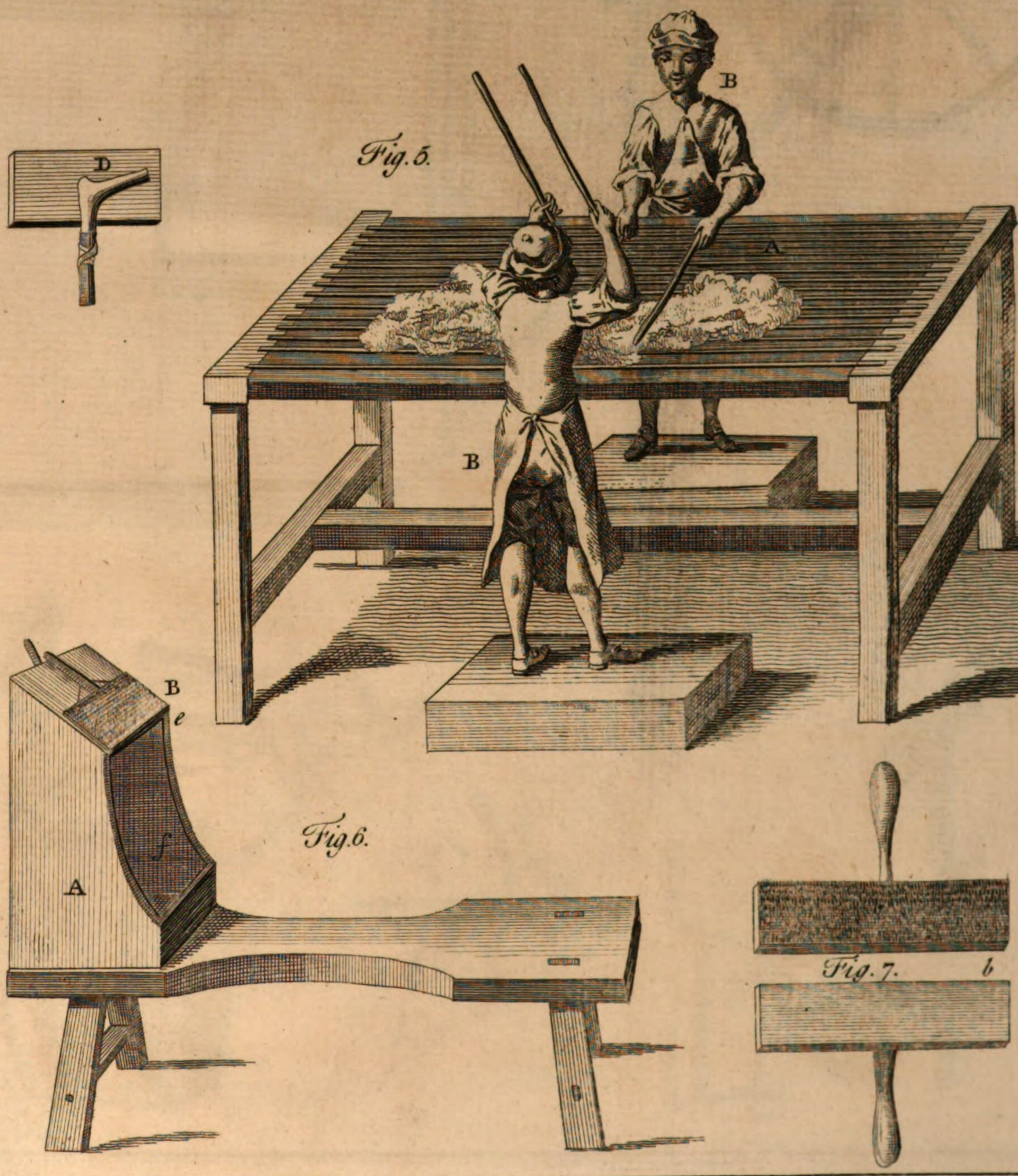
D
Fig. 5.
B
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e
f
A
Fig. 6.
Fig. 7.
b

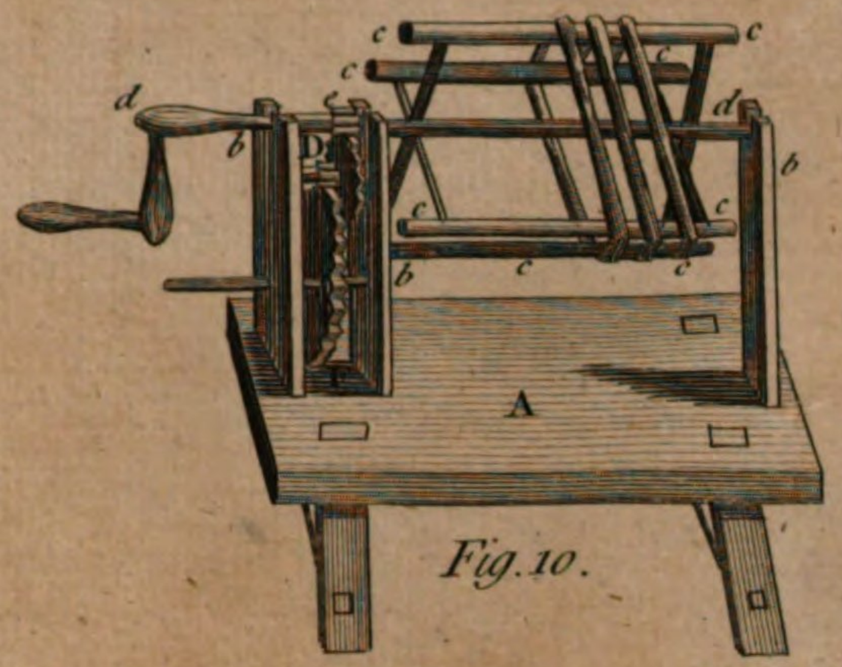


Fig. 10.

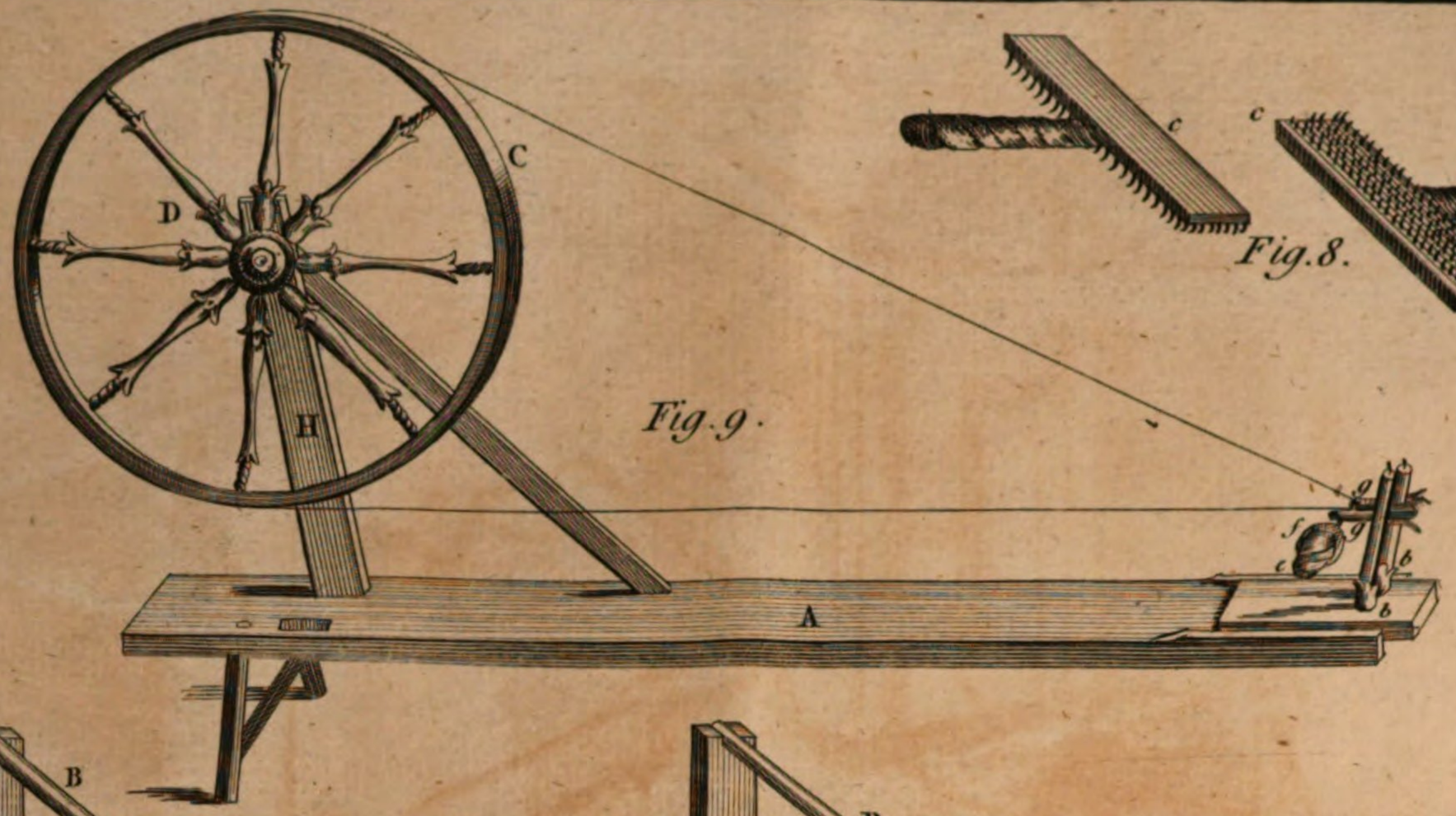
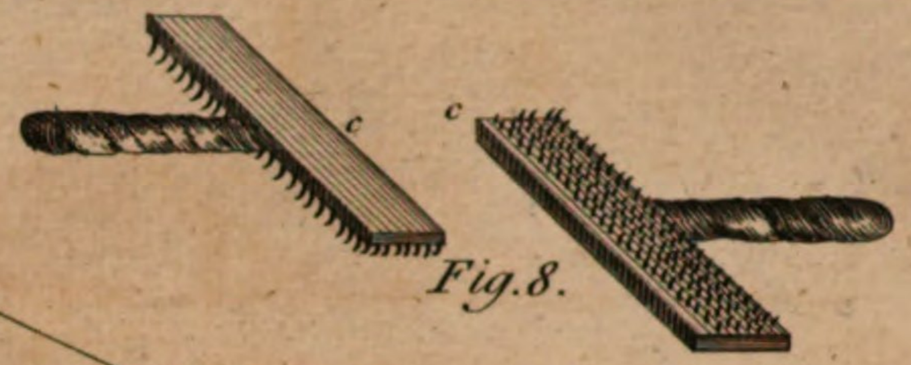


Fig. 9.



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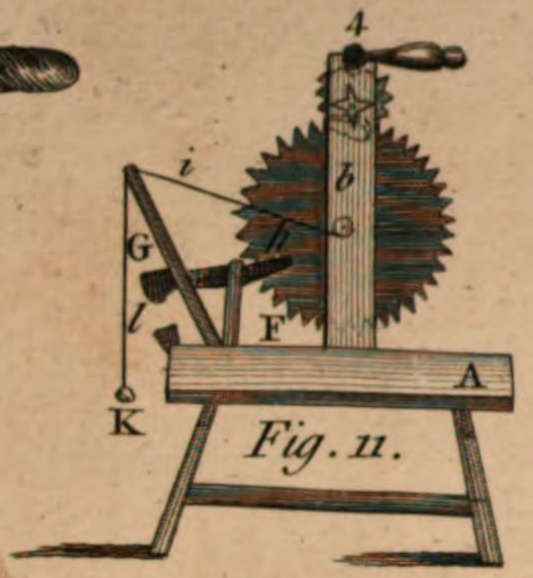

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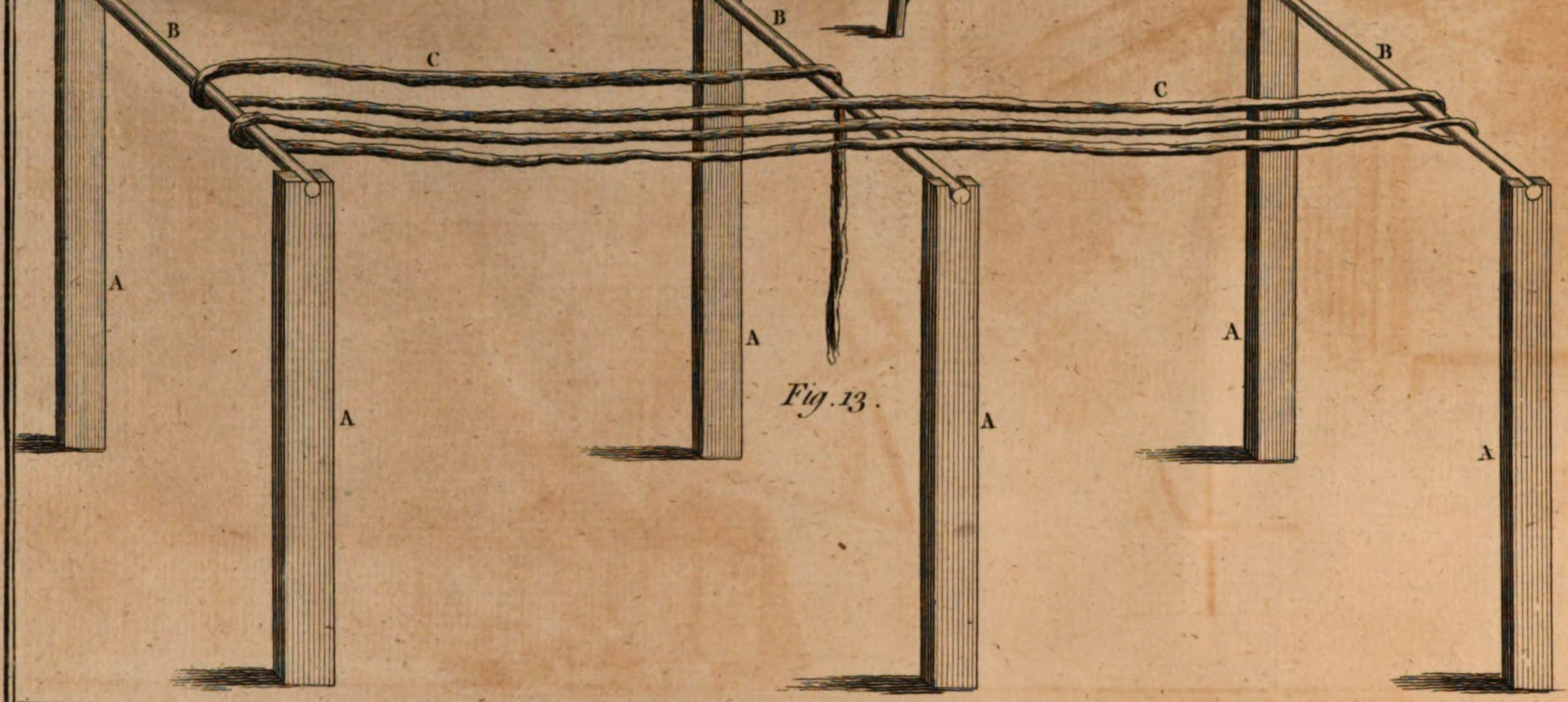
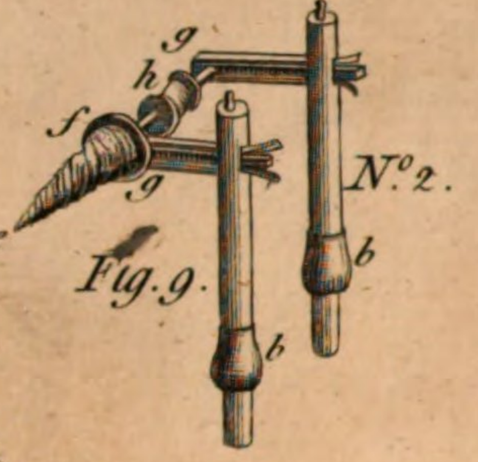


Fig. 13.



N°. 2.

Fig. 9.

Fig. 12.

Fig. 14.

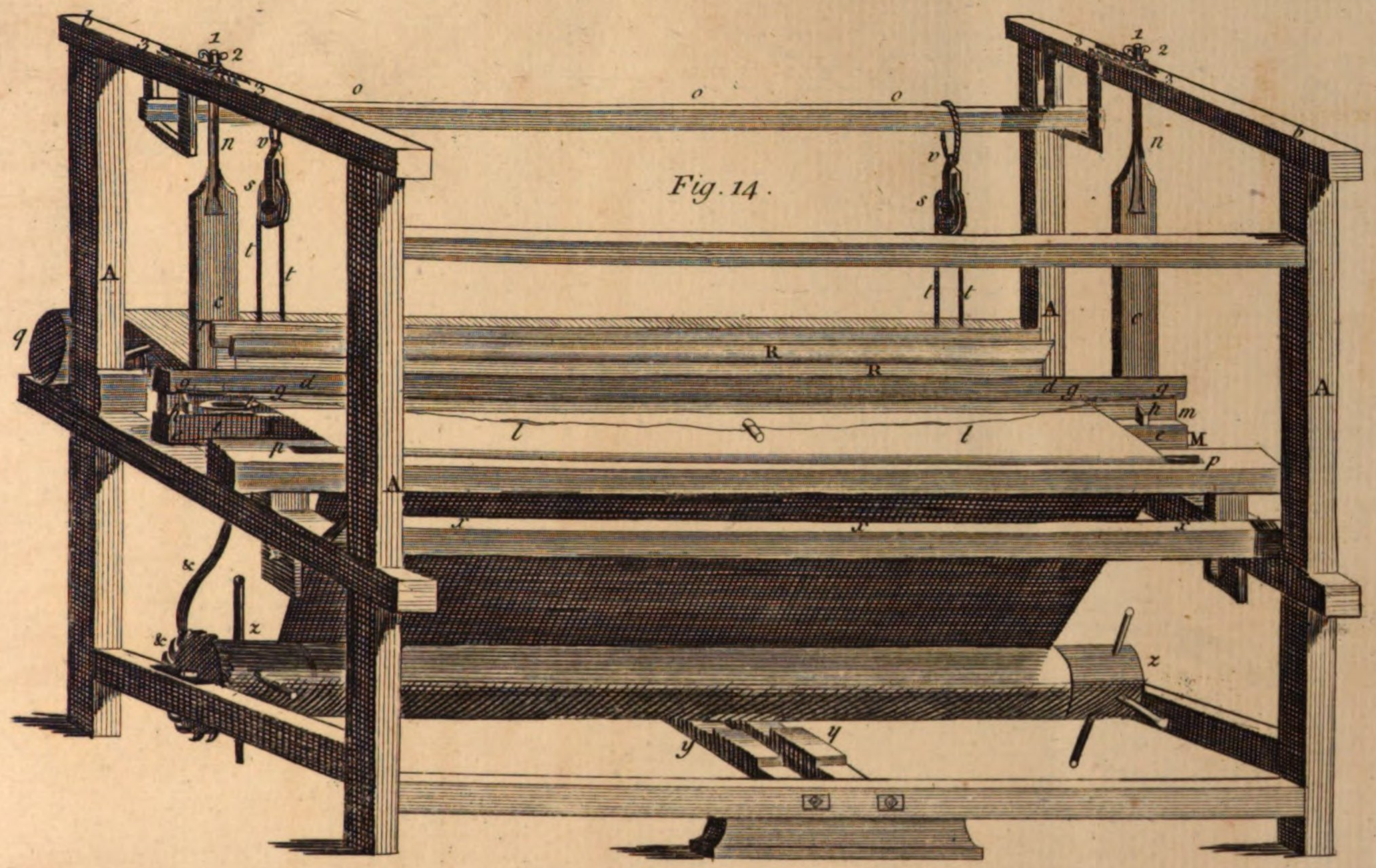


Fig. 15.

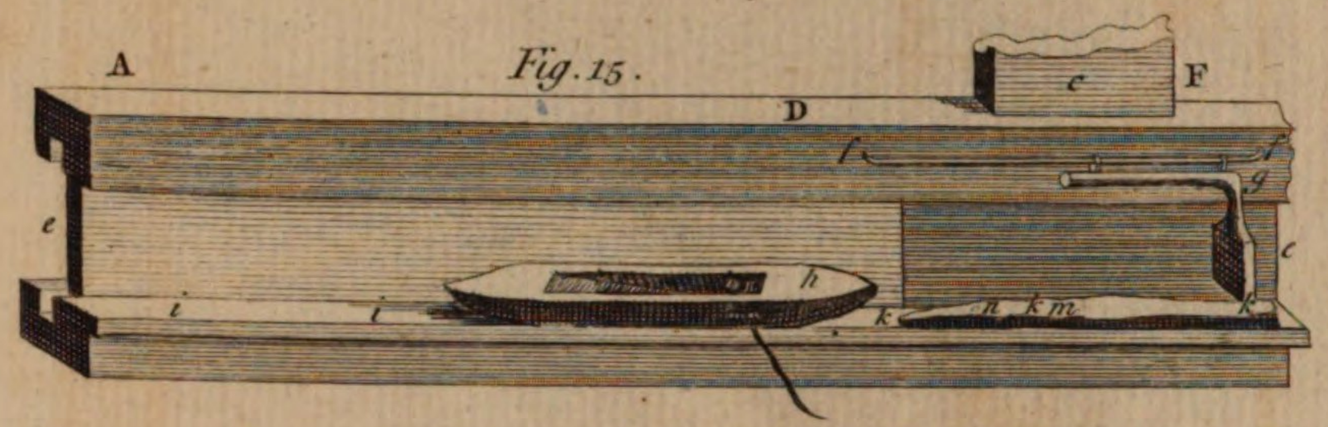
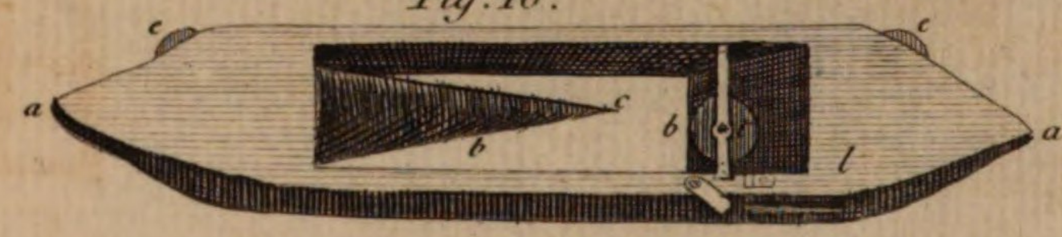


Fig. 16.



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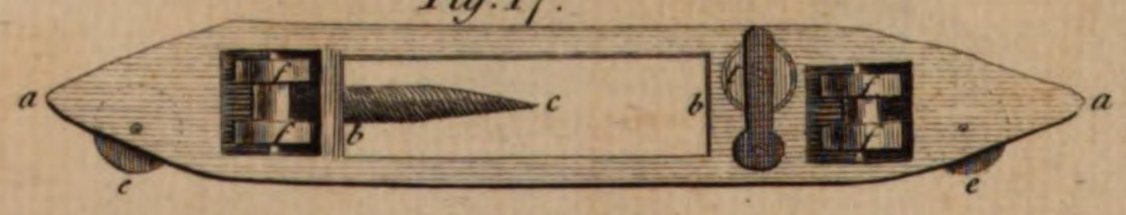


Fig. 18.

Fig. 22.

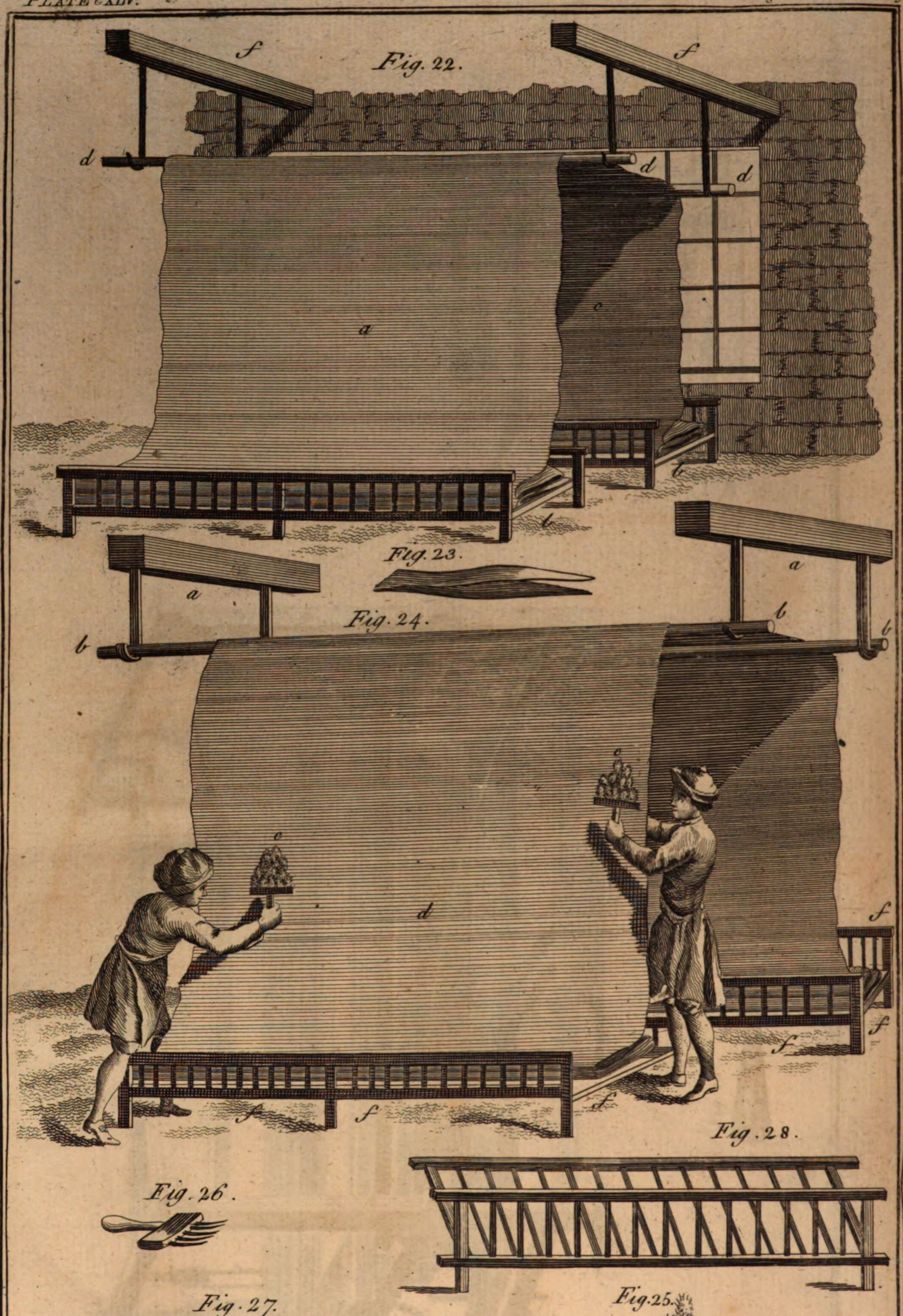


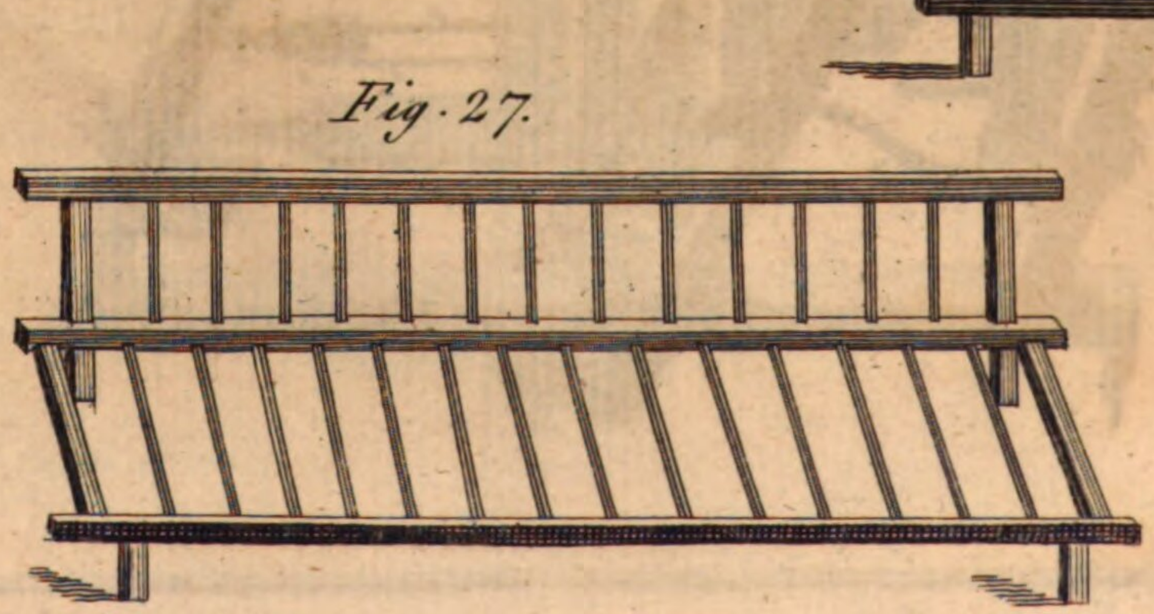
Fig. 23.

Fig. 24.

Fig. 28.

Fig. 26.

Fig. 27.



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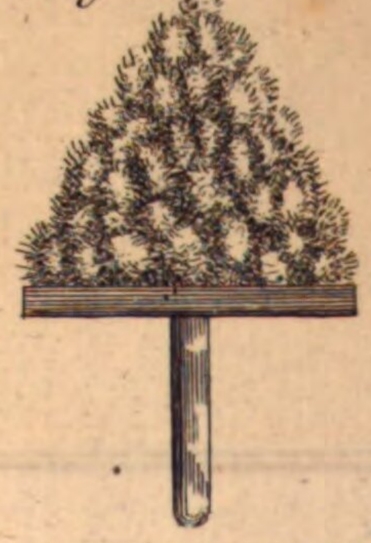

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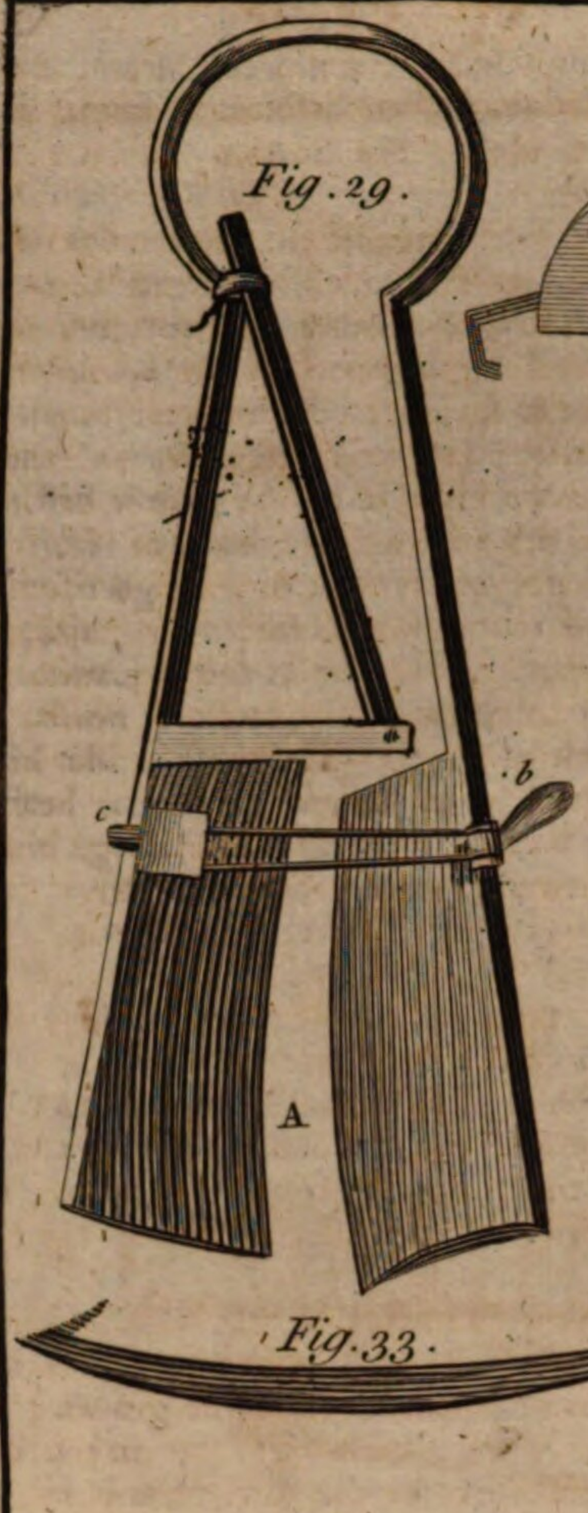

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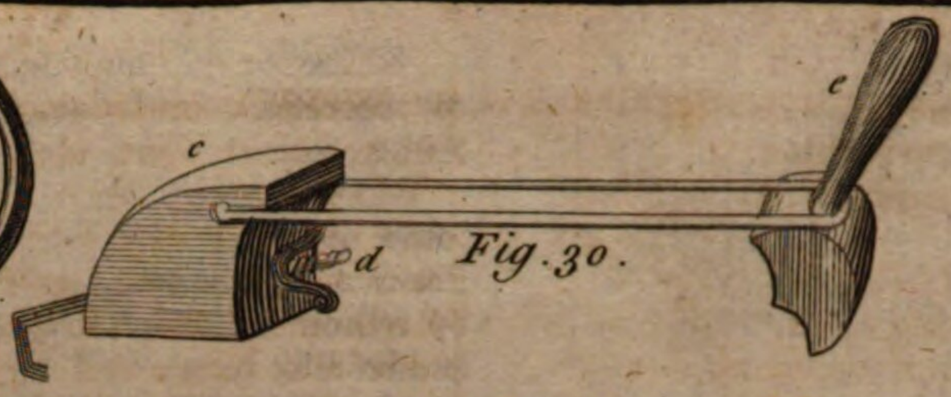

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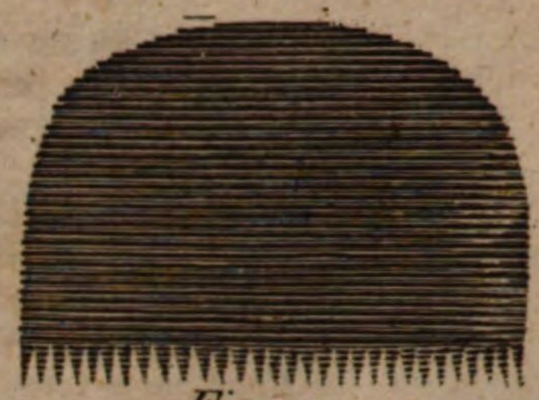
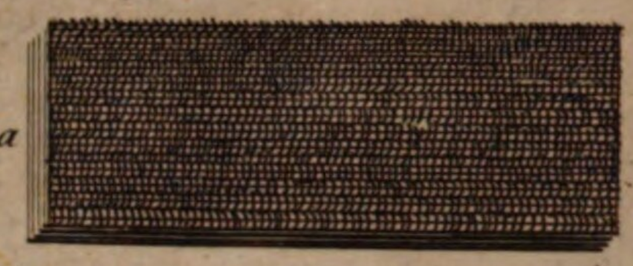


Fig. 31.

Fig. 32.



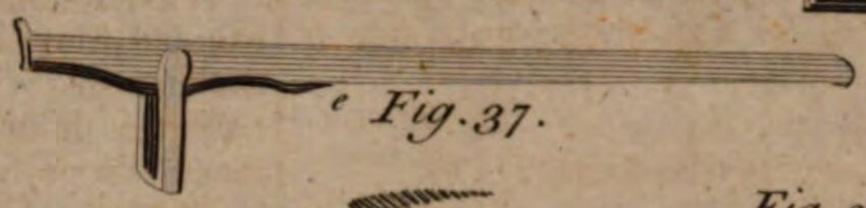
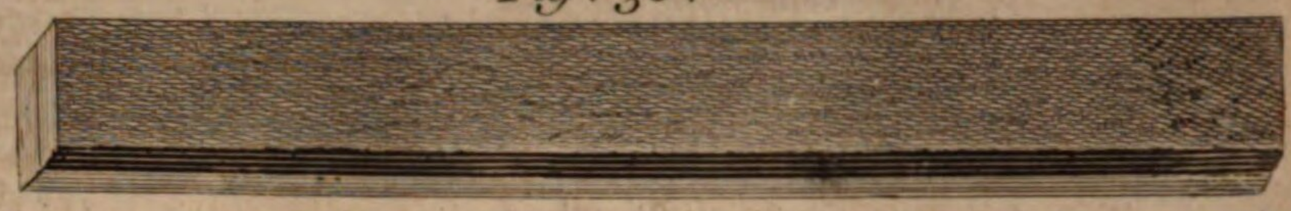
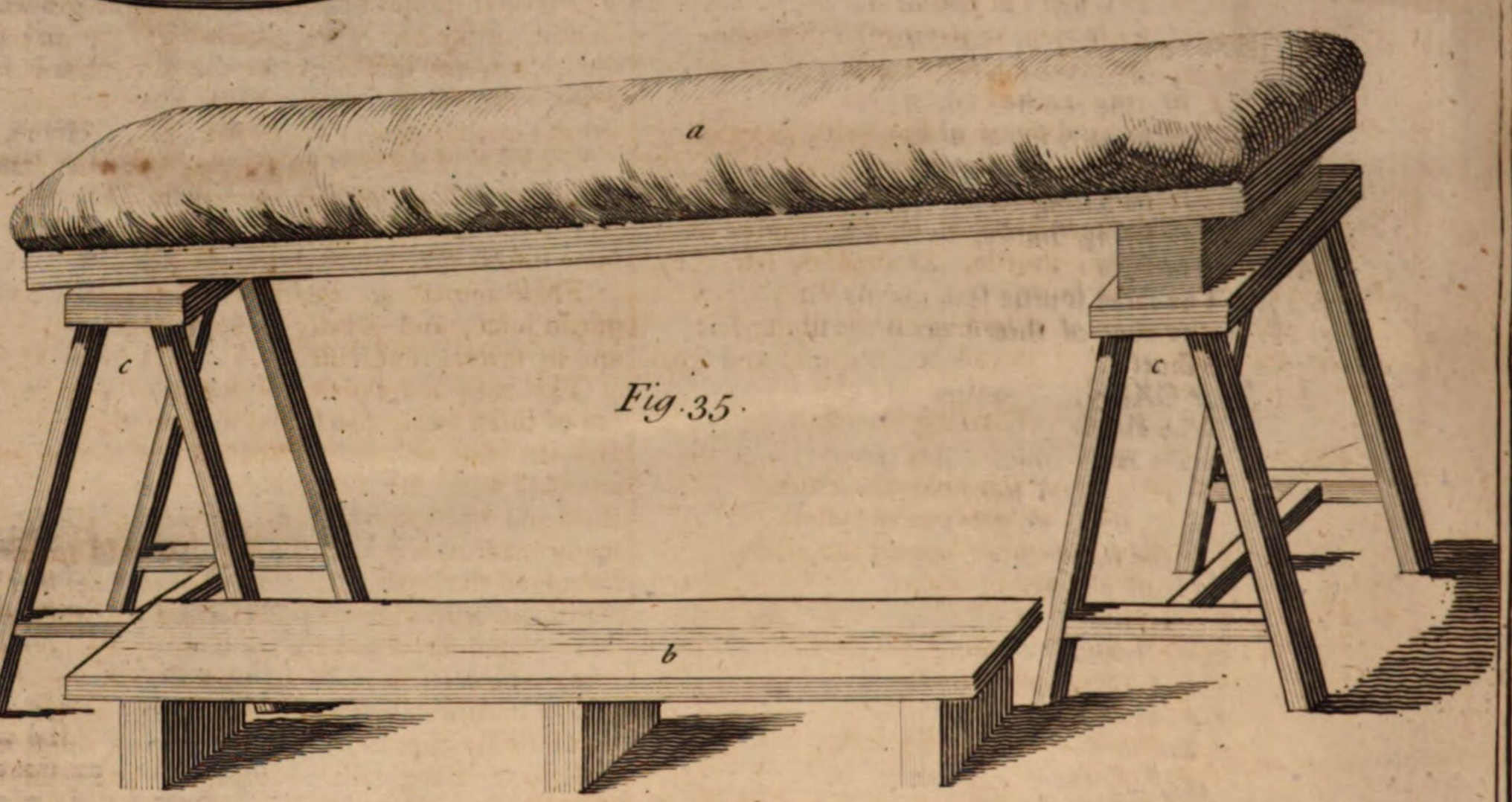


Fig. 37.

Fig. 34.

Fig. 38.





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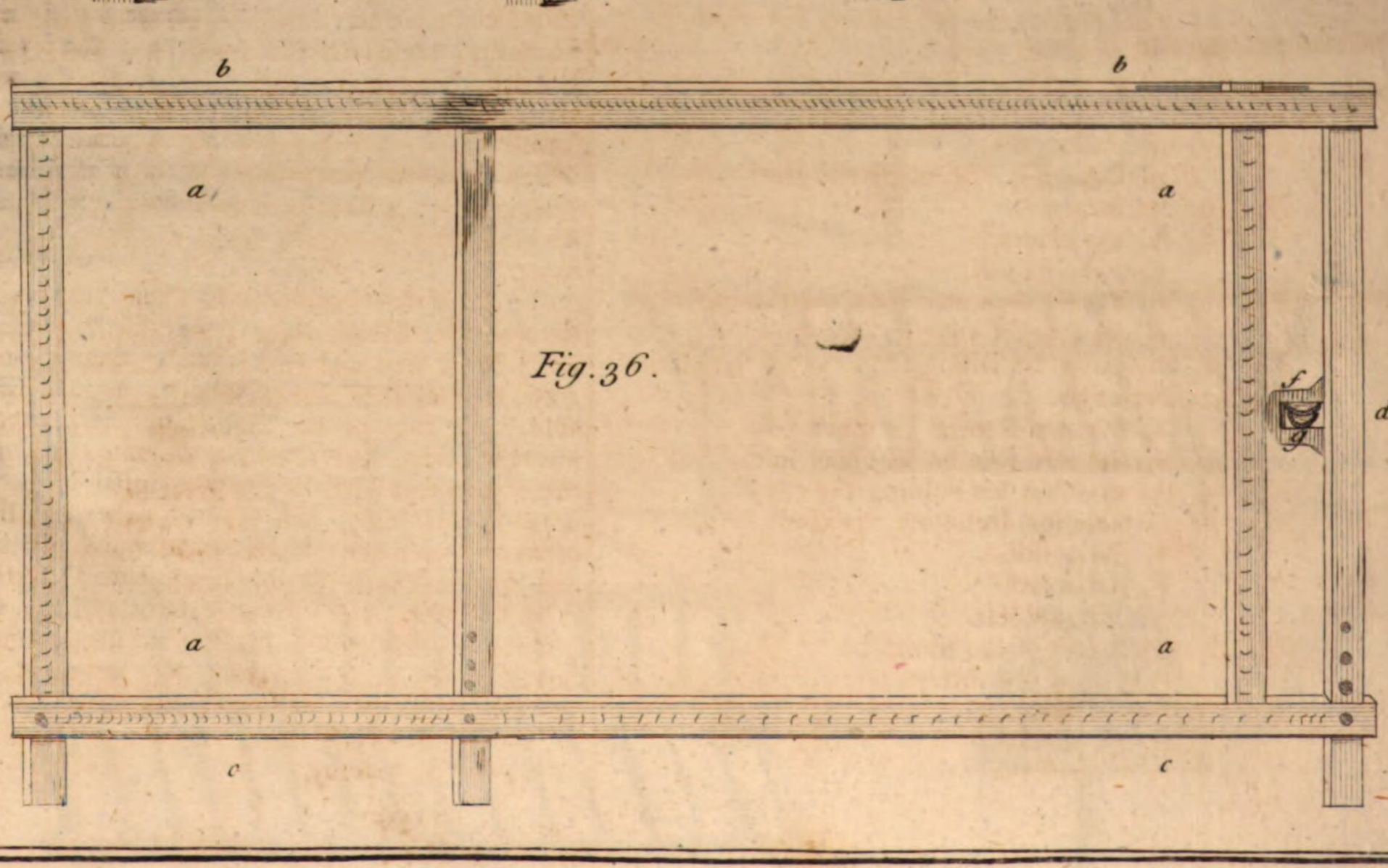

Fig. 36.

Fig. 13. Stretching the chains.
A, A, A, A, &c. the poſts.
B, B, B, the traverſe pieces.
C, the chain.

Plate CXLIV.

Fig. 14. A loom for weaving cloth.
A, A, A, A, poſts of the loom.
b, *b*, the croſs bars.
c, *c*, the batten.
d, *d*, the cap of the batten.
F, the ſliding-board, or that which ſupports the threads of the woof, and on which the ſhuttle moves.
g, *g*, a croſs piece of iron ſupporting the ſquare which returns the ſhuttle.
h, the ſquare.
i, a piece of wood againſt which the ſhuttle ſtrikes.
k, the ſhuttle.
l, *l*, a thread left by the ſhuttle.
m, the reed.
M, a piece of wood ſquared to the reed.
n, *n*, needle of the batten.
o, *o*, the ſupport of the pullies.
p, *p*, the breaſt-bar.
q, the cane-roll.
r, *r*, the bar which ſupports the ſmoothers.
R, R, the ſmoothers.
s, *s*, pullies.
t, *t*, *t*, *t*, the tumblers, or ropes of the pullies.
v, *v*, ſtraps of the pullies.
x, *x*, back bar, or feet of the weaver.
y, *y*, treadles, or foot-boards.
z, *z*, the knee-roll.
&, &, the toothed wheel, with its catch.
1, 2, nut and ſcrew of the batten.
3, 3, 3, 3, cramp-irons.

Fig. 15. part of the ſliding-board, with the ſhuttle on it.

Fig. 16. The flying ſhuttle, invented by Mr. Key, ſeen on the upper ſide.

Fig. 17. The ſame ſhuttle ſeen on the under ſide.

Fig. 18. The cone of thread on its quill, and ſeparated from the ſhuttle.

Plate CXLV. Teazling the cloth.

Fig. 22. *a*, the cloth.
b, the rack which holds the cloth.
c, the interval between the cloth.
d, *d*, *d*, poles which ſupport the cloth.
f, *f*, the ſupporting beams.

Fig. 23. a pair of nippers.

Fig. 24. the manner of teazling the cloth.
a, *a*, ſupporting beams.
b, *b*, *b*, poles.
c, *c*, bruſhes formed of teazles.
d, the cloth.
f, *f*, *f*, *f*, racks for holding the cloth.

Fig. 25. A bruſh of teazles.

Fig. 26. The comb for placing and regulating the teazles.

Fig. 27, 28. racks.

Plate CXLVI. Shearing the cloth.

Fig. 29. the ſhears.
A, the blades.
b, *c*, the handle.

Fig. 30, the handle ſeparated from the ſhears.
c, the bracket with its ſcrew, *d*.

Fig. 31. the cards for raiſing the hairs of the cloth.

Fig. 32. the cards.
a, the card ſeen on its under ſide.
b, the card ſeen on its upper ſide.

Fig. 33, 34, cratches for holding the cloth.

Fig. 35. A table for ſtretching the cloth.
a, the cuſhion.
b, the board.
c, *c*, the treſſels.

Fig. 36. upper part of the frame.
a, *a*, *a*, *a*, the intervals.
b, *b*, *c*, *c*, ſide-pieces.
f, the block.
g, the pulley.

WORD, in language, an articulate ſound deſigned to repreſent ſome idea. See SOUND, VOICE, SIGN, IDEA, &c.

WORD, or *Watch* WORD, in an army or garriſon, is ſome peculiar word or ſentence, by which the ſoldiers know and diſtinguiſh one another in the night, &c. and by which ſpies and deſigning perſons are diſcovered. It is uſed alſo to prevent ſurprizes. The word is given out in an army every night to the lieutenant, or major-general of the day, who gives it to the majors of the brigades, and they to the adjutants; who give it firſt to the field-officers, and afterwards to a ſerjeant of each company, who carry it to the ſubalterns. In garriſons it is given after the gate is ſhut to the town-major, who gives it to the adjutants, and they to the ſerjeants.

WORK, in the manege.—To work a horſe, is to exerciſe him at pace, trot, or gallop, and ride him at the manege. To work a horſe upon volts, or head and haunches in or between two heels, is to paſſage him, or make him go ſide-ways upon two parallel lines.

WORKS, *Opera*, in fortification, the ſeveral lines, trenches, ditches, &c. made round a place or army, or the like, to fortify and defend it.

WORLD, *Mundus*, the aſſemblage of parts which compoſe the univerſe. See the article UNIVERSE.

WORMS, in the Linnæan ſyſtem of nature, a claſs of inſects of the order of the apteria, and of the claſs of the anarthra.

The diſtinguiſhing character of this claſs is, that they have the muſcles of their body affixed to a ſolid baſis. The ſeveral ſpecies of worms are very numerous; as the chætia, or the hair-worm, called alſo the guinea worm; the aſcaris, the lumbricus or the earth worm; and ſea-worm; the tænia, or tape-worm; the ſicyania or gourd worm; the iulus or gally-worm, &c.

WORMS, *Lumbrici*, or *Vermes*, in medicine, certain living animals of various figures, ſtructures, and bulks, which are formed in the inteſtines, from the ſeeds of ſome inſects taken in with the aliments.

Theſe animals are nouriſhed in the body by a certain putrid juice, and greatly weaken and injure the body, and its ſeveral functions.

The belly is frequently the ſeat of worms; and they are of three ſorts, the round ſmooth ſort, the aſcarides, and the flat or jointed worms; children are chiefly troubled with the firſt and ſecond; and adults with the third and worſt ſort. Theſe have been all treated of by many medical writers: but the learned Daniel Le Clerc has given the moſt accurate deſcription of the flat worm, illuſtrated with figures. And as he has refuted the erroneous opinions of ſome phyſicians concerning this creature, which ſeems to be an animal of a ſingular nature; I have borrowed from him the following remarks. Firſt, it manifeſtly appears, that this is not a ſingle worm but a chain of many leſſer worms, of that kind which are called cucurbitine, linked together in a continued ſeries. Secondly, theſe latter are ſometimes found, of a finger's breadth, lying ſingle and ſeparate in the inteſtines, and are ſo diſcharged by the anus. Laſtly, the whole worm formed of a concatenation of theſe has but one head, which is pretty ſharp-pointed, ſometimes reſembling a beak; which it fixes into the coats of the inteſtines, and ſticking there very faſt, ſucks the chyle for its nouriſhment.

To theſe obſervations of Le Clerc I ſhall add, ſays the learned Dr. Mead, ſome few from my own practice; for I have ſeen and cured this diſeaſe more than once. And, indeed, it is a truth equally ſtrange and diſagreeable, that though the medicines have deſtroyed, and brought away, ſeveral of the ſmall worms, which were the component parts of the great one; yet, others daily breed in the body, and join themſelves to the reſt, in order to repair the breach, until the head is expelled; and then at length the whole animal is diſcharged with it by the anus, and is frequently ſeveral feet long. But it is not at all ſurpriſing that the ſharp beak above mentioned ſhould cauſe pain; and that the perſon who entertains this devouring gueſt, and is under a neceſſity of ſupplying its daily food, ſhould waſte in his fleſh, and even run into a decay.

Wherefore, theſe pernicious broods of worms are to be deſtroyed by all poſſible means; and this is eaſily done with regard to the ſmooth and round ſort, and the aſcarides. Quick-ſilver in every form is deſtructive of them; and, therefore, it will be very proper to order a purge of rhubarb with a ſmall portion of mercurius dulcis, which is to be repeated at due intervals; and, on the intermediate days, to give æthiops mineral morning and evening. Moreover, it will be of ſervice to drink ſpring water, in which quickſilver has been boiled; and even ſea-water alone. In fine, oil injected by the anus does good.

But the flat worm requires a peculiar treatment; and after many years experience, I recommend the following medicine as very efficacious in this caſe.

Take filings of tin, and red coral, of each an equal quantity; pound them together into a very fine powder; of which one dram, made into a bolus, with conſerve of the tops of ſea-wormwood, is to be taken twice a day.

In fine, the ſame medicines, which have deſtroyed and cleared the bowels of theſe inteſtine enemies, are to be repeated from time to time to prevent their return. *Mead.*

WORM-SEED, a hot, bitter, drying kind of ſeed, often given to deſtroy worms in the human body.

This ſeed is ſmall, of a browniſh colour, an oblong figure, a bitter taſte, and a ſtrong ſmell.—It muſt be choſen new, greeniſh, of a ſharp, bitter, aromatic taſte, not a little diſagreeable.

The place where it is produced is Perſia, about the frontiers of Muſcovy. It is brought to us from Aleppo, &c. Naturaliſts are not agreed about the plant that produces it. J. Bauhine has a large diſſertation on the ſubject. Some will have it the ſpecies of abſynthium, or wormwood, called ſantonicum, or marinum abſynthium; others will have it the tanacetum, others the abrotanum.

M. Tournefort gives us the following account of this notable drug, in the ſecond volume of his Travels. The ſementine, or worm-powder, is not gathered like our ſeeds. The plant grows in the meadows, and muſt be let ripen; and the miſchief is, that as it grows near to maturity, the wind ſcatters a good part of it among the graſs, where it is loſt; and this it is makes it ſo dear.

As they dare not touch it with the hand, for fear of making it ſpoil the ſooner; when they would gather what is left, in the ear, they have recourſe to this expedient. They take two hand-baſkets, and, walking along the meadows, ſweep the baſkets, right to left, the other from left to right, as if they were mowing; by this means the ſeed is ſhook out into the baſkets.

WORMWOOD, *Abſinthium*, in botany. See the article ABSINTHIUM.

WORSHIP *of God*, the offering up of adoration, prayer, praiſe, thankſgiving and confeſſion to God, as our creator, benefactor, lawgiver and judge.

WORSTED, a kind of woollen thread, which, in the ſpinning, is twiſted harder than ordinary. It is chiefly uſed either wove or knit into ſtockings, caps, gloves, or the like.

WOULDING, a ſea-term for the winding of ropes round a maſt or yard of a ſhip, that has been ſtrengthened by a piece of timber nailed to it.

WOUND, *Vulnus*, in medicine and ſurgery, is frequently defined to be a violent ſolution of the continuity of the ſoft external parts of the body, made by ſome inſtrument. Others take a greater latitude in defining it, and call every external hurt of the body, by what cauſe ſoever produced, a wound. On the other hand, ſome are of opinion that unleſs the injured parts of the body are divided by ſome ſharp inſtrument, as by a ſword or knife, it is by no means to be called a wound; but notwithſtanding, it is certain that thoſe wounds which are produced by blunt inſtruments may properly enough be called wounds, whence Heiſter diſtinguiſhes two different kinds of wounds, the one made by acute, the other by blunt inſtruments.

Wounds are generally inflicted upon the ſofter parts of the human body, ſuch as the ſkin, fat, muſcular fleſh, ligaments, blood-veſſels, and nerves, and parts that are compoſed of theſe, as the viſcera and inteſtines; yet the more ſolid parts of the body are by no means to be here excluded, as the bones, whence the parts that are ſubject to thoſe injuries, will afford two diſtinctions of wounds; one, wounds of the ſofter parts, the other, wounds of the bones.

As cauſes of wounds, all inſtruments of what kind ſoever, whether blunt or ſharp, may properly be reckoned, provided they are of ſuch a nature, that upon the violent external application of them, they are capable of producing a ſolution of continuity in the parts of the body upon which they are inflicted; for a ſolution of the external parts by internal cauſe is not called a wound, but rather an abſceſs, or ulcer; ſo when the harder parts of the body, as the bones, are broken by a fall, or a violent blow received from a blunt inſtrument, it is called a fracture.

The effects which are produced by wounds, beſides the diviſion of the ſofter parts, are generally profuſions of blood, though they are ſometimes attended with much greater miſchiefs than theſe; for it can ſcarcely happen, but that the divided parts muſt, in ſome meaſure, if not totally, loſe their natural functions, according to the different uſes for which the part is intended, and according to the different degrees of injury that it receives.

The greater number of uſes a part is intended for by nature, the worſe will be the conſequences of a wound upon that part; this principle is ſo extenſive, that it is the conſtant guide in forming a prognoſtic, whether a wound will prove mortal or not. He, therefore, who is beſt ſkilled in anatomy, that is, beſt inſtructed in the ſituation of the parts, and their uſes, will be enabled to form the moſt accurate judgment of the conſequence that will neceſſarily attend a wound upon any particular part.

What has been ſaid of the different ſituations and cauſes of wounds, ſufficiently demonſtrates, that there are many different kinds of wounds, ſome brought on by a puncture, ſome by a ſtab, and ſome again by a blow; ſome are curable, others incurable; ſome are made with ſharp inſtruments, others with blunt ones: with regard to their figure, ſome form a right line, others are curved, tranſverſe, or oblique: with reſpect to their ſituation, ſome are placed in the head, others in the neck, thorax or abdomen; and of theſe, ſome are internal, others external. Variety of different wounds ariſe from the great diverſity of condition that wounds are left in; for in ſome wounds, the inflicting inſtrument, or part of it, remains; for inſtance, a leaden bullet, a piece of glaſs, or of a granade; the points of arrows or ſwords: but in ſome wounds, nothing of this kind is left: ſometimes fractures of the bones accompany wounds, which is generally the caſe in gun-ſhot wounds: ſome wounds are alſo attended with poiſon, as thoſe which are made with poiſoned arrows; under this head may be ranked the bites of animals, but more particularly of mad or venomous animals. Some are of opinion, that wounds which are made with copper, or ſilver inſtruments, ſhould be reckoned in this claſs, the poiſon of which, if there is any, is owing to the vitriol that is mixed with theſe metals.

In ſlight wounds, where no conſiderable artery, nerve, or tendon is concerned, the following appearances are uſually remarkable; at firſt ſight, the wound appears as a red line drawn upon the part; but upon being dilated, the blood inſtantly guſhes out in greater or ſmaller quantities, according to the ſize and number of the blood-veſſels that are injured.

The hæmorrhage, after a ſhort continuance, ſtops of its own accord, and the blood concreting in the wound, forms a cruſt; the lips of the wound now begin to look red, and ſwell, and are attended with ſome degree of pain and inflammation; if it is a large wound, a fever, that is to ſay, an univerſal heat and quickneſs of pulſe, almoſt always enſue upon the third or fourth day; ſooner or later, a white glutinous humour appears, not unlike oil, and this is known by the name of pus, or matter; upon appearance of matter, the redneſs, tumour, pain, inflammation, and fever, diſappear entirely, or at leaſt are abated; and theſe are the ſigns of a wound inclining to heal; for under the matter new fleſh ſprings up from the wounded veſſels,

which having by degrees filled the wound, dries upon its upper part, and forms a cicatrix.

In dangerous wounds, that is, where any conſiderable blood-veſſel is wounded or divided, there generally enſues ſo violent a hæmorrhage, that the wounded perſon is in an inſtant ſenſible of great loſs of ſpirits, and weakneſs, and faints away: and when the larger arteries are wounded, whether they are internal or external, he dies upon the ſpot; although ſomewhat leſs danger is apprehended from wounds that are inflicted upon the veſſels, which are ſituated upon the external parts of the body, ſome few excepted, becauſe they will admit of the ligature, and other means of reſtraining the violence of the hæmorrhage.

There is nothing will give a truer light into the nature and conſequence of a deep wound, than a due conſideration of what natural actions of the body are impeded thereby. For inſtance, in wounds of the breaſt, when the patient draws his breath with ſhortneſs and difficulty, and is at the ſame time attended with a hæmoptyſis and hiccough, it may be rationally conjectured, that the lungs or the diaphragm are wounded; ſo in wounds of the abdomen, when chyle is voided, it is a plain indication that the ſtomach, ſmall guts, or lacteals are wounded: when excrements paſs by the wound, the great guts are wounded.

Bilious blood likewiſe ſhews the liver or gall-bladder to be divided: if urine paſſes by the wound, the urinary bladder, or elſe the ureters, are wounded; and bloody urine denotes a blow on the kidneys, or a wound of the bladder; but when there are large profuſions of blood this way, it is a ſign that ſome of the larger blood-veſſels are wounded: vomiting of blood declares the ſtomach to be the injured organ: violent pains attended with convulſive twitches, ſhew that a nerve is wounded, or elſe that ſome foreign ſubſtance is left in the wound. Whenever the ſenſes are diſordered after a wound received on the head, a concuſſion of the brain is much to be feared. Difficulty of breathing, pains in the breaſt, and hiccoughing, are ſymptoms of a wound in the diaphragm.

It is of bad conſequence for a wound to be attended with a large tumour; but it is of the laſt conſequence if it is attended with no degree of tumour at all: the firſt is an indication of great inflammation, the laſt of mortification; ſome degree of tumour is always therefore beſt in wounds.

In order to enquire what wounds admit of a cure and what are incurable, Heiſter divides wounds into three ſorts. 1. Some wounds are abſolutely of themſelves mortal. 2. Others are in their own nature mortal, if not relieved by timely aſſiſtance. And, 3. Others become mortal by accident or imprudent treatment, though they were otherwiſe curable.

1. We properly ſtyle thoſe wounds mortal which are not to be remedied by all the art and induſtry of man. Thus, wounds are of this kind which are attended with ſo violent an hæmorrhage as to produce inſtant death: of this ſort are reckoned wounds that penetrate the cavities of the heart, and all thoſe wounds of the viſcera where the large blood-veſſels are opened; ſuch are large wounds of the lungs, liver, ſpleen, kidneys, ſtomach, inteſtines, meſentery, pancreas, uterus; of the aorta, of the iliac, cœliac, renal, meſenteric, and carotid arteries: eſpecially if they are wounded near their origin: of the ſubclavian alſo, or vertebral; of the vena cava, iliac vein, the internal jugular vertebral, renal, meſenteric; of the vena porta, and of the larger veins that lie deep in the body, becauſe their ſituation will not admit of proper applications to reſtrain the flux of blood. Heiſter therefore reckons, very juſtly, theſe among the wounds that are abſolutely incurable, ſince they are not remediable either by aſtringents, ligature, or fire.

Thoſe wounds alſo are not leſs mortal than the former, which obſtruct, or entirely cut off the paſſage of the animal ſpirits to the heart; ſuch are wounds of the cerebellum, of the medulla oblongata, and ſome violent ſtrokes of the brain itſelf.

There is reaſon to apprehend very great danger, when the ſmall veins or arteries which are contained in the cranium, are injured; for the blood flowing from them into the internal ſinuſes of the brain, either produces too great a preſſure upon thoſe very tender parts of the brain, and ſo obſtructs the courſe of the blood and ſpirits; or elſe, being corrupted, it putrifies the brain itſelf, if it cannot be evacuated by the aſſiſtance of the trepan; which is the caſe when this accident happens at the lower part of the cranium, or in the ſinuſes of the brain; nor is there leſs danger where the nerves which tend to the heart are wounded, or entirely divided; for, after this, it is impoſſible for the heart to continue its motion.

To this claſs are to be referred alſo all wounds which entirely deprive the animal of the faculty of breathing: there is therefore great danger where the aſpera arteria is entirely divided; for where it is only divided in part, it may be healed again by the aſſiſtance of an expert ſurgeon: to this place alſo belong violent ſhocks of the bronchia, mediaſtinum, and diaphragm, eſpecially the tendinous parts of it.

Thoſe wounds alſo which interrupt the courſe of the chyle to the heart, are no leſs incurable than the former; ſuch are wounds of the ſtomach, inteſtines, receptacle of the chyle, thoracic duct, and larger lacteals; to which may be alſo added wounds of the œſophagus, if they are large; though death is not ſo ſudden an attendant on theſe wounds; but, for want of nouriſhment, the perſons afflicted by them are weakened by degrees, and at length die conſumptive.

In this account thoſe wounds alſo are not to be omitted, which are inflicted upon membranous parts, that are ſituated in the abdomen, and contain ſome ſecreted fluid, as on the bladder, either of the bile or urine, the ſtomach, inteſtines, receptacle of the chyle, and lacteal veſſels. The fluids contained in theſe parts, when once they are let looſe into the cavity of the abdomen, cannot be properly diſcharged, and therefore eaſily corrode the internal parts of the body; and the membranes that contained them are generally ſo fine, that they will not admit of agglutination, eſpecially ſince no medicine from without can be applied. A few indeed have recovered after ſlight wounds in theſe parts; but ſince the number of theſe inſtances is but few, and the cure in them has been accidental, and not performed by the ſurgeon's art, theſe may very juſtly be added to the liſt of mortal wounds.

2. Many wounds there are which though the experienced ſurgeon could remedy, yet prove fatal, if neglected, or left to nature: of this number are thoſe which produce inſtant death, unleſs relieved by preſent aſſiſtance; ſuch are wounds of the larger external blood-veſſels, which might be remedied by ligature, by the application of aſtringent medicines, or the actual cautery. Of this kind are wounds of the brachial, or crural artery, unleſs they are too near the trunk of the body; wounds in the large arteries of the cubit, or tibia of the branches of the external carotid, or temporal artery; to theſe alſo may be added wounds of the jugular and other veins, ſituated upon the external parts of the body; but in theſe caſes no help can be given, unleſs the ſurgeon be brought before there there has been a vaſt profuſion of blood.

3. Wounds are properly ſaid to become mortal by accident, where the patient's death from them is occaſioned either by the ill conduct of the patient himſelf, or by the neglect or ignorance of his ſurgeon; the wound itſelf being of the number of thoſe deemed curable by the judicious practitioner. Under this head are to be reckoned, 1. Thoſe wounds which the ſurgeon has neglected to cleanſe ſufficiently, though he had not it in his power to do it; as when ſome foreign body, which might eaſily have been extracted, is left in the wound, and produces inflammations, hæmorrhages, convulſions, and finally death itſelf; ſo in wounds of the thorax and abdomen, if the ſurgeon does not uſe his utmoſt diligence to evacuate the grumous blood, it will corrupt there, and by drawing the neighbouring parts into conſent, will expoſe the patient to death: great care muſt alſo be taken that the lips of the wound do not cloſe till the blood that is collected in the cavity of the body be all evacuated if poſſible, which will be eaſily perceived by the difficulty of breathing, and other bad ſymptoms going off; but if any of the larger internal veſſels are wounded, then all attempts to diſcharge the blood are vain, for the violence of the hæmorrhage

hæmorrhage takes off the patient. 2. Wounds are alſo to be accounted mortal by accident, which are treated or ſearched in too rough a manner by the ſurgeon; for if wounds are handled roughly, which are full of nervous parts, or of large blood-veſſels, there is great danger of bringing on hæmorrhages, convulſions, inflammations, gangrenes, and finally death itſelf. The caſe is alſo the ſame, 3. in external wounds, which are ſlight of themſelves, but under which the patient is loſt by the inflammation, which is increaſed and brought on by the ſurgeon's injudicious treatment; or, 4. when any one is taken off by the violence of the hæmorrhage from a wound of the hand or foot; for in this caſe, the ſurgeon might eaſily have ſtopped the blood by the application of proper remedies, or by ligature; or, 5. when the patient is guilty of any intemperance in eating or drinking, or of any exceſs of paſſion, of expoſing himſelf to the cold air, or of uſing violent exerciſe. For by theſe means, wounds, more eſpecially thoſe of the head, by being liable to freſh hæmorrhages, and other dangerous accidents, frequently become mortal, notwithſtanding they naturally would not prove ſo, and though the ſurgeon uſes his utmoſt care and ſkill. 6. Among theſe are to be accounted thoſe wounds of the head, where the patient is loſt by the vaſt quantity of blood which is extravaſated in the cavity of the cranium, and confined there; but where he might have been relieved if the trepan had been applied in time; for though wounds of this kind generally prove incurable, yet, as there is at leaſt a poſſibility of ſaving a perſon in theſe circumſtances, by the uſe of the trepan, this may properly be reckoned among the doubtful caſes, and not deemed abſolutely mortal. 7. And laſtly, a bad habit of body prevents the cure of wounds, which would admit of an eaſy cure in healthy ſubjects; ſo we often ſee the ſlighteſt puncture on the hand or foot of an hydropical, conſumptive, or ſcorbutic perſon, ſhall produce a gangrene, and prove mortal; though the ſurgeon ſpares no care nor application to prevent it.

Cure of WOUNDS.—Since a wound is a ſolution of the continuity of the parts of the body, the reunion of thoſe parts ſeems to be the principal intention; but ſince wounds are of very different kinds, ſome ſlight, and others of great conſequence, in proportion to this difference, ſo will the manner of proſecuting this intention differ.

The cure of ſlight wounds is generally performed with great eaſe, by applying a ſmall portion of lint to the part, well ſaturated with ſpirit of wine, oil of eggs, turpentine, baſilicon, the balſam of Arcæus, of Peru, &c. ſecuring the dreſſings with a plaſter, and renewing them once in a day or two: by this means, the lips of the wound will preſently agglutinate.

Wounds which are attended with ſome danger, are to be treated as follows: in the firſt place, the wound is to be cleanſed from all extravaſated blood, ſordes, &c. In the next place, if a bullet, the point of a ſword, any part of the clothing, a piece of glaſs, or any other foreign body, ſhall remain in the wound, it is to be removed with the fingers, or with proper inſtruments for the occaſion.

The hæmorrhage is to be ſtopped at the firſt dreſſing; the divided parts are to be brought as near each other as poſſible, and their ſituation is to be ſo maintained, that the cicatrix which is left may appear even.

The method of treating a cut, or ſuch a wound as is made by a cutting inſtrument, where no part of the fleſh is taken off, and the accident happens to the external parts of the body, and does not penetrate deep, after the wound is cleanſed, it ſhould be dreſſed with the ſame vulnerary balſam, and the lips of the wound ſhould be cloſed, and kept in that ſituation. This is done after different methods, according to the difference of the wound; as,

1. It is to be done by placing the wounded part in a proper poſture; that is, as ſoon as the wound is dreſſed, the part ſhould be placed in ſuch a ſituation, that the divided parts may be moſt likely to keep in conſtant contact.

2. By a proper bandage, tying up the parts ſo that the lips may meet, and thereby eaſily unite.

By a proper ſuture, which differs according to the difference of the wound, but may be generally divided into the dry and bloody ſuture; the dry, or as ſome call it, the baſtard ſuture, is the application of ſticking plaſters, to keep the lips of the wound united; the bloody, or true ſuture, is performing the ſame thing with a needle and thread. See SUTURE.

If the wound heals by the aſſiſtance of the ſuture, the threads or ligatures are to be cut near the knots; the lower lip of the wound is to be ſuſpended with one hand, while the threads are gently drawn out by the other; the punctures that are left will eaſily heal by the application of a vulnerary water, called by the French, *l'eau d'arquebuſade*; or by injecting aqua calcis, or ſpirit of wine, and laying on compreſſes dipped in the ſame liquors: but larger wounds are to be dreſſed with the balſam of Arcæus, or balſam of Capivi, and the lips kept firm together with ſome ſticking plaſter till a firm cicatrix is formed.

Where there is a loſs of ſubſtance, the wound will not unite either by the help of plaſter, or ſuture, till it is filled up with new fleſh. For this purpoſe, you will find lint dipped in oil, or ſpread with ſome vulnerary balſam, or ointment, and applied to the bottom of the wound, very ſerviceable, covering it with a plaſter, compreſs and proper bandages, and this dreſſing is to be repeated daily.

As hot or cold air is very hurtful to wounds, ſo it muſt by all means be kept from them; for which reaſon, the ſurgeon ſhould be careful not to remove the old dreſſings till the freſh ones are got ready, and to be as expeditious as poſſibly in applying them. After this, when a white, even, thick, matter appears in the wound, it ſhould be dreſſed as you ſee occaſion, every day, or every other day; the ſuperfluous matter ſhould be wiped away with a very light hand; for it is better to leave ſome behind, than to treat the wound roughly. Theſe rules being obſerved, the fleſh will ſpring up preſently, and the wound unite; and in order to perfect the cure of the wound, an even cicatrix ſhould, if poſſible, be procured.

When any uncleanneſs or foulneſs is perceived in a wound, that is, if the fleſh is putrid, fungous, black or livid, it muſt be well cleanſed before any attempt is made to heal it; for which purpoſe apply a digeſtive ointment, made with turpentine, yolk of eggs, and honey of roſes; and where this is not ſtrong enough, ſubſtitute the Egyptian ointment, or ſpirit of wine diluted; or if you require more ſtrength, uſe red precipitate mercury. Applications of this kind are to be continued till the wound is entirely clean; after which, recourſe is to be had to the methods already preſcribed. If the new fleſh ſhould be luxuriant, and riſe up ſo as to prevent the formation of an even cicatrix, it muſt be taken down with green vitriol, or a powder compoſed of burnt alum, and red precipitate mercury; at the ſame time making a proper preſſure, with the plaſters, compreſſes, and bandages, till the parts are even.

The patient ſhould obſerve a ſtrict regimen with regard to his diet and manner of life, as nothing forwards the cure ſo much as a good habit of body, which may be procured by obſerving a ſtrict regularity with regard to diet, air, keeping the paſſions under, and indulging neither too much ſleep, nor ſuffering too great watchfulneſs; and it is to be obſerved, that the greater tendency there is in a patient to a diſeaſed ſtate of body, ſo much the ſtricter courſe of life ought he to obſerve.

The bowels ſhould by all means be kept open, eſpecially in thoſe who have received a wound in the head; however, it is to be obſerved, that ſtrong cathartic medicines are to be avoided; but it is not only ſafe but adviſeable to eat and drink thoſe things that may at the ſame time nouriſh and keep the body open. To this end the patient may drink plentifully of tea or coffee, may eat ſtewed prunes, roaſted apples: but hard meats of all kinds are forbid: where the patient is ſo bound up, that a diet of this kind has no effect, it will be neceſſary to have

have recourſe to medicines, but then thoſe muſt be of the mildeſt kind; here a gentle clyſter may be given, a ſuppoſitory may be uſed, or an ounce or two of manna, or ſome purging ſalts in warm broth may be preſcribed: whenever the violence of the wound, or the ill habit of the patient require the uſe of internal remedies, vulnerary drinks will be found to be of the greateſt conſequence, in compoſing which, the conſtitution of the patient, and the nature of the complaint ſhould be diligently conſulted; for if the patient is of a phlegmatic habit of body, cold, pale, or naturally ſubject to tumours, then the vulnerary decoction ſhould be compoſed of herbs that attenuate and divide the blood.

If the patient has a thin ſharp blood, then decoctions of viſcous and glutinous plants will be proper; but if he is vexed with great pain or wakefulneſs, then ſome opiates muſt be adminiſtered. If he ſhould be troubled with an acidity, abſorbents are proper; and when a quickneſs of pulſe, and an extraordinary heat are perceived, they are ſure ſigns of a ſymptomatical fever.

WOUNDS *in Horſes*. The moſt terrible wounds theſe creatures are ſubject to, are thoſe got in the field of battle. The farriers that attend camps, have a coarſe way of curing theſe; but it is a very expeditious and effectual one.

If the bullet be within reach, they take it out with a pair of forceps; but if it lie too deep to be come at, they leave it behind, and dreſs up the wound in the ſame manner as if it were not there. They firſt drop in ſome varniſh from the end of a feather, and when the bottom is thus wetted with it, they dip a pledget of tow in the ſame varniſh, which they put into the wound, and then cover the whole with the following charge: take a quarter of a pound of powder of bole armenic, half a pound of linſeed oil, and three eggs, ſhells and all; add to theſe, four ounces of bean flour, a quart of vinegar, and five ounces of turpentine; this is all to be mixed over the fire, and the wound covered with it.

This application is to be continued four or five days; then the tent put into the wound is to be dipped in a mixture of turpentine and hogs-lard; by this means a laudable matter will be diſcharged, inſtead of the thin ſharp water that was at firſt. Then the cure is to be completed by dreſſing it with an ointment made of turpentine, firſt well waſhed, and then diſſolved in yolks of eggs, and a little ſaffron added to it.

This is the practice in deep wounds that do not go through the part; but in caſes where the bullet has gone quite through, they take a few weavers linen thrumbs, made very knotty; theſe they make up into a kind of link, and dipping it in varniſh, they draw it through the wound, leaving the ends hanging out at each ſide; by means of theſe they move the link or ſkain three or four times a day, always wetting the new part that is to be drawn into the wound with freſh varniſh.

They put on a charge of bole armenic, &c. as before deſcribed, on each ſide of the wounded part, and continue this as long as the wound diſcharges thin watery matter, or the ſides continue ſwelled. After this, they dreſs it with the ointment of turpentine, yolks of eggs, and ſaffron, till it is perfectly cured.

The other methods are the dreſſing the wound with an ointment made of wax, turpentine, and lard, and covering it with linen rags wetted with cream, or the dreſſing with a mixture of yolks of eggs, honey, and ſaffron, and covering it with cream and balm leaves beaten together.

When the wound is ſo dangerous as to require the aſſiſtance of internal medicines, they give the following pills: take aſſa-fœtida, bay-berries, and native cinnabar, of each a pound; beat up the whole into a maſs with brandy, and roll it into pills of fourteen drams weight each. Theſe are to be laid in a ſhady place to dry, after which they will keep a long time without any damage. The horſe is to take two of theſe every other day, or, if neceſſary, every day, till he has taken eight or ten of them; and he is to ſtand bridled two hours before and after taking them.

When the wound ſeems at a ſtand, not appearing foul, and yet not gathering new fleſh, there muſt be recourſe had to the following powder, whoſe effect in bringing new fleſh is wonderful: take dragon's-blood and bole armenic, of each two ounces; maſtic, olibanum, and ſarcocolla, of each three drams; aloes, round birth-wort, and common iris root, of each a dram a half; make the whole into a fine powder. This is ſometimes uſed dry, ſprinkling it on the wound; but ſometimes it is mixed with turpentine, ſometimes with juice of wormwood, and ſometimes with hony of roſes, and either way does very well.

When the wound grows foul, and requires a detergent to cleanſe it, the common liquor for this purpoſe is a phagedenic water, which they make of lime-water and ſublimate in this manner: take two pounds and a half of newly made and unſlacked lime, put it into a pewter veſſel, and pour on it five quarts of boiling water; when the bubbling is over, let it ſtand to reſt two or three days, ſtirring it often with a ſtick: then pour it clear off, after a due time, for the lime to ſettle; and filtre it through ſome whited-brown paper, made for the lining of funnels on this occaſion.

To a quart of clear lime-water thus prepared, add eight ounces of ſpirit of wine, and one ounce of ſpirit of vitriol; when theſe are well mixed by ſhaking them together, then add an ounce of corroſive ſublimate in fine powder: mix all well together, and keep the whole in a bottle to be uſed for cleanſing theſe foul wounds, and on any other occaſion where there may be a detergent of this powerful kind neceſſary. It will keep good many years.

If this water will not thoroughly cleanſe the wound, but there ſtill will remain a quantity of foul matter in it, and there is danger of a gangrene, they add to it as much arſenic, in fine powder, as there was of the corroſive ſublimate; that is, at the rate of an ounce to a quart and half a pint.

WREATH, in heraldry, a roll of fine linen or ſilk, like that of a Turkiſh turban, conſiſting of the colours borne in the eſcutcheon, placed in an atchievement between the helmet and the creſt, and immediately ſupporting the creſt. See CREST, &c.

WRECK, or *Ship*-WRECK, in law, is when a ſhip periſhes on the ſea, and no perſon eſcapes alive out of it. In this caſe, if the ſhip ſo periſhed, or any part thereof, or the goods of the ſhip come to the land of any lord, and are left there, the lord ſhall have the ſame, as being a wreck of the *ſea: but if any ſingle* perſon, or even a dog, or other living creature, eſcape alive out of the ſhip, the party to whom the goods belong, may come within a year and a day, and proving the goods to be his, he ſhall have them again. And it is held, that they are no wrecks ſo long as they remain at ſea, within the juriſdiction of the admiralty.

It is enacted by 12 Ann. c. 18. that if any wreck happen by any fault or neligence of maſter or mariners, the maſter muſt make good the loſs; but if the ſame was occaſioned by tempeſt, enemies, &c. he ſhall be excuſed: making holes in ſhips, or doing any thing wilfully tending to the loſs thereof, is by that ſtatute declared felony.

WRECK, in metallurgy, a veſſel in which the third waſhing is given to the ores of metals.

WRESTLING, a kind of combat or engagement between two perſons unarmed, body to body, to prove their ſtrength and dexterity, and try which can throw his opponent to the ground.

It was the cuſtom for the Athletæ to anoint their bodies with oil, to give the leſs hold to their antagoniſt. Lycurgus ordered the Spartan maids to wreſtle in public, quite naked, in order to break them of their too much delicacy and niceneſs, to make them appear more robuſt, and to familiarize the people to ſuch nudities.

WRIST, *Carpus*, in anatomy, a part of the hand, conſiſting of eight ſmall, unequal, and irregular bones; all which taken together, repreſent a ſort of grotto, of an irregular quadrangular figure, and connected principally with the baſis of the radius. See the article HAND.

WRIST, in the manege. The bridle-wriſt is that of the cavalier's left hand. A horſeman's wriſt and his elbow ſhould be equally raiſed, and the wriſt ſhould

be two or three fingers above the pummel of the ſaddle.

WRIT, in law, ſignifies in general the king's precept in writing under ſeal, iſſuing out of ſome court, directed to the ſheriff, or other officer, and commanding ſomething to be done in relation to a ſuit or action, or giving commiſſion to have the ſame done. And, according to Fitzherbert, a writ is ſaid to be a formal letter of the king in parchment, ſealed with his ſeal, and directed to ſome judge, officer, or miniſter, &c. at the ſuit of a ſubject, for the cauſe briefly expreſſed, which is to be determined in the proper court according to law.

WRIT *of aſſiſtance*, that iſſuing out of the exchequer, to authorize ſome perſons to take a conſtable, or other public officer, to ſeize prohibited or unaccuſtomed goods or merchandize.

WRITER *of the tallies*, an officer of the exchequer, being clerk to the auditor of the receipt, who writes, upon the tallies, the whole letters of the teller's bill.

WRITING, *Scriptura*, the art or act of ſignifying and conveying our ideas to others, by letters, or characters, viſible to the eye. See the articles CHARACTER, LETTER, WORD, &c.

Writing is now chiefly practiſed among us by means of pen, ink, and paper; tho' the ancients had other methods.

To write without blacking the fingers, Mr. Boyle directs us as follows. Prepare the paper with a fine powder made of three parts of calcined copperas, two of galls, and one of gum arabic; thoſe being freſh mixed, rub them with a hare's foot into the pores of the paper, and write with fair water, and the black letters will immediately appear.

To make new writing appear old, the ſame author directs to moiſten it well with oil of tartar per deliquium, more or leſs diluted with water, as you deſire the ink to appear more or leſs decayed.

We may write without ink or its materials. For this purpoſe take a fine powder of calcined hartſhorn, of clean tobacco pipes, or rather of mutton-bones burnt to a perfect whiteneſs, and rub it upon the paper, and then write with a ſilver bodkin, or the like.

WRONG, in a logical ſenſe. See ERROR, FALSEHOOD, TRUTH, &c.

WYCH-HOUSE, a houſe in which ſalt is boiled.

WYTE, or WITE, in our ancient cuſtoms, a pecuniary penalty or mulct. The Saxons had two kinds of puniſhments, were and wyte; the firſt for the more grievous offences, and the latter for the leſſer ones.

X.

X, A double conſonant, and the twenty-ſecond letter of the Engliſh alphabet.

The letter X was not uſed by the Hebrews or ancient Greeks; for as it is not a ſimple but compound letter, the ancients, who uſed great ſimplicity in their writings, expreſſed it by *cs*, the letters which compoſe it; thus, inſtead of the modern πλεξω, the ancient Attics wrote πλεκσω.

X, is alſo a numeral letter, ſignifying ten, as it repreſents two V's placed one on the top of the other. When laid flat, thus ⋈, it ſignifies a thouſand; and when a daſh is added over it, as $\overline{X}$, it ſignifies ten thouſand.

XANTHICA, in antiquity, a Macedonian feſtival, ſo called becauſe it was obſerved in the month Xanthus, which, as Suidas tells us, was the ſame with April. At this time the army was purified by a ſolemn luſtration, in the following manner: they divided a bitch into two halves, one of which, together with the entrails, was placed upon the right hand, the other upon the left; between theſe the army marched in this order; after the arms of the Macedonian kings came the firſt part of the army; theſe were followed by the king and his children, after whom went the life-guards, and the reſt of the army. This done, the army was divided into parts, one of which being ſet in array againſt the other, there followed a ſhort encounter, in imitation of a fight.

XANTHIUM, the leſſer burdock, in botany, a genus of plants, producing male and female flowers; the corolla is compound, uniform, tubuloſe, and equal, and diſpoſed in an hemiſpherical form; the partial flower is monopetalous, tubuloſe, funnel-ſhaped, erect, and divided into five ſegments at the limb: the fruit is a dry ovato-oblong berry, bifid at the apex, hairy, and covered with hooked prickles, containing an oblong ſeed, plane on one ſide, and convex on the other. See the article BARDANA.

XERANTIMUM, the Auſtrian ſneeze-wort, in botany, a genus of plants, whoſe flower is compound and unequal; the corollulæ, which form the diſc, are tubuloſe and hermaphrodite; and a few female quinquifid florets compoſe the radius: there is no pericarpium; but the cup, which is imbricated and cylindric, contains the ſeeds, which are oblong and crowned with hair.

The flowers of theſe plants being gathered when full blown, and properly dried, will continue freſh and beautiful ſeveral months; and by dipping them into various tinctures, they may be ſtained of different colours. They are propagated by ſowing the ſeeds, either in ſpring or autumn, and afterwards the plants ſhould be ſet where they are intended to blow.

XEROPHAGIA, in church-hiſtory, the eating of dried foods: ſo the ancient Chriſtians called certain faſt days, on which they eat nothing but bread and ſalt, and drank only water: ſometimes they added pulſe, herbs, and fruits. This ſort of faſting was obſerved chiefly in the holy week, out of devotion, and not by obligation.

XESTA, an Attic meaſure of capacity. See MEASURE.

XIPHIAS, the ſword-fiſh, in ichthyology, a genus of fiſhes. The roſtrum, or extremity of the head, is continued forward, with an extremely long point, of a depreſſed, or ſomewhat flatted figure, reſembling the blade of a ſword, and of a bony ſtructure; the lower jaw is acute, and of ſomewhat a triangular figure; the body is oblong, and of a roundiſh figure, and is conſiderably thick in proportion to its length; the back is convex,

convex, and the ſides are rounded; there is no belly fins, and on the back there is only one fin, which is very long, and loweſt in the middle; the branchioſtege membrane on each ſide contains only eight bones. About fifteen feet in length is the ſize of a moderately large one, but not unfrequently it is met with much bigger.

XIPHIAS, is alſo a fiery meteor, in form of a ſword. It differs from the acontias in this, that the latter is longer, and more like a dart; and the former ſhorter and broader in the middle.

XIPHION, in botany, a genus of plants, differing from the iris by having a bulbous root and ſubulated leaves; but by Linnæus is claſſed among them. See IRIS.

XIPHOIDES, in anatomy, a cartilage adhering to the ſternum; called alſo cartilago enſiformis. See STERNUM.

XYLO-ALOES, or ALOE-WOOD, in pharmacy, a drug diſtinguiſhed into three ſorts; the calambac, the common lignum aloes, and calambour.

The calambac, or fineſt aloe-wood, called by authors, lignum aloes preſtantiſſimum, and, by the Chineſe, ſukhiang, is the moſt reſinous of all the woods we are acquainted with: it is of a light ſpongy texture, very porous, and its pores ſo filled up with a ſoft and fragrant reſin, that the whole may be preſſed and dented by the fingers like wax, or moulded about by chewing in the mouth, in the manner of maſtic.

This kind, laid on the fire, melts in great parts like reſin, and burns away in a few moments, with a bright flame and perfumed ſmell. Its ſcent, while in the maſs, is very fragrant and agreeable; and its taſte acrid and bitteriſh, but very aromatic and agreeable: it is ſo variable in its colour, that ſome have divided it into three kinds; the one variegated with black and purple; the ſecond, with the ſame black, but with yellowiſh inſtead of purple; and the third, yellow alone, like the yolk of an egg: this laſt is the leaſt ſcented of the three; the ſubſtance, however, in them all, is the ſame in every reſpect, except the colour. It is brought from Cochinchina.

The lignum aloes vulgare, is the ſecond in value. This is of a more denſe and compact texture, and conſequently leſs reſinous than the other: there is ſome of it, however, that is ſpongy, and has the holes filled up with the right reſinous matter; and all of it, when good, has veins of the ſame reſin in it.

We meet with it in ſmall fragments, which have been cut and ſplit from larger; theſe are of a tolerably denſe texture, in the more ſolid pieces, and of a duſky brown colour, variegated with reſinous black veins. It is in this ſtate very heavy, and leſs fragrant than in thoſe pieces which ſhew a multitude of little holes, filled up with the ſame blackiſh matter that forms the veins in others. The woody part of theſe laſt pieces is ſomewhat darker than the other. and is not unfrequently purpliſh, or even blackiſh. The ſmell of the common aloe-wood is very agreeable, but not ſo ſtrongly perfumed as the former. Its taſte is ſomewhat bitter and acrid, but very aromatic. This is alſo brought from Cochinchina, and ſometimes from Sumatra.

The calambour, or, as ſome write it, the calambouc, is alſo called agallochum ſylveſtre, and lignum aloes Mexicanum. It is a light and friable wood, of a duſky and often mottled colour, between a duſky green black, and a deep brown. Its ſmell is fragrant and agreeable, but much leſs ſweet than that of either of the others; and its taſte bitteriſh, but not ſo much acrid or aromatic as either of the two former. We meet with this very frequently, and in large logs; and theſe ſometimes entire, ſometimes only the heart of the tree, the cortical part being ſeparated. This is brought from the iſland of Timor, and is the aloe-wood uſed by the cabinet-makers and inlayers.

The Indians uſe the calambac by way of incenſe, burning ſmall pieces of it in the temples of their gods; and ſometimes their great people burn it in their houſes, in times of feaſting.

It is eſteemed a cordial, taken inwardly; and they ſometimes give it in diſorders of the ſtomach and bowels, and to deſtroy worms. A very fragrant oil may be procured from it, by diſtillation, which is recommended in paralytic caſes, from five to fifteen drops. It is at preſent, however, but little uſed, and would ſcarce be met with any where in the ſhops, but that it is an ingredient in ſome of the old compoſitions.

XYLO BALSAMUM, a name which naturaliſts give to the wood of the tree which yields that precious gum known to the Latins by the name of opobalſamum, and to us by the name of balm of Gilead.

We have branches of this tree brought from Cairo; they are very ſtraight, brittle, unequal, and full of knots; their bark is reddiſh without, and greeniſh within.

The xylo-balſamum is reputed good to ſtrengthen the brain and ſtomach, and to expel poiſon. See BALSAM.

XYLO-CASSIA, in the materia medica, the ſame with the caſſia-ligna. See CASSIA.

XYLON, in botany, a name uſed by ſome authors for the bombax of Linnæus. See the article COTTON.

XYLOPIA, in botany, a genus of plants, whoſe flower conſiſts of ſix ſeſſile, linear, lanceolated, coriaceous petals, the three outward ones being larger: the ſtamina have no filaments, but conſiſt of numerous antheræ ſitting on the germen: the fruit is a dry, roundiſh, unilocular drupe, containing a roundiſh kernel.

XYSTARCHA, in antiquity, the maſter or director of the xyſtus. In the Greek gymnaſium, the xyſtarcha was the ſecond officer, and the gymnaſiarcha the firſt; the former was his lieutenant, and preſided over the two xyſti, and all exerciſes of the athletæ therein.

XYSTUS, among the Greeks, was a long portico, open or covered at the top, where the athletæ practiſed wreſtling and running: the gladiators, who practiſed therein, were called xyſtici.

Among the Romans, the xyſtus was only an alley or double row of trees, meeting like an arbour, and forming a ſhade to walk under.

Y.

YAR

Y, The twenty-third letter of the Engliſh alphabet.

The letter Y was not in the ancient Hebrew alphabet, though they were not without the ſound of it in their ' jod, if the pronunciation of the ancient Jews was the ſame as the modern.

The figure of the letter Y was doubtleſs derived from that of the V, for they ſeem to have been both the ſame letter in the moſt ancient Greek alphabet; for V is in the fifth line, and Y in the ſeventh of the Sigean inſcription, for the ſame letter. It is formed by expreſſing the breath with a ſudden expanſion of the lips from the configuration by which we expreſs the vowel *u*.

Y is one of the ambigeneal letters, being a conſonant at the beginning of words, and placed before all vowels; as *yarn*, *year*, *young*, &c. And, at the end of words, it is a vowel, and is ſubſtituted for the ſound of *i*, as in *my*, *deſcry*, *deny*, &c. Y, is alſo a numeral letter ſignifying 150, or according to Baronius, 159.

When a daſh was added at top, $\overline{Y}$, it ſignified, 150,000. Pythagoras uſed the *y* as a ſymbol of human life; the foot repreſenting infancy, and the forked top the two paths of virtue and vice, one or the other of which people are to enter upon, after attaining to the age of diſcretion.

YACHT, or YATCH, a veſſel with one deck, carrying from four to twelve guns. See SHIP.

YARD, a meaſure of length uſed in England and Spain, chiefly to meaſure cloth, ſtuffs, &c. See MEASURE.

YARD, in anatomy. See PENIS.

YARD-LAND, is taken to ſignify a certain quantity of land, in ſome countries being fifteen acres, and in others twenty; in ſome twenty-four, and in others thirty and forty acres.

YARDS *of a Ship*, are thoſe long pieces of timber which are made a little tapering at each end, and are fitted each athwart its proper maſt, with the ſails made faſt to them, ſo as to be hoiſted up, or lowered down, as occaſion ſerves. See the article SHIP.

YARD-ARM, is that half of the yard that is on either ſide of the maſt, when it lies athwart the ſhip.

YARDS, alſo denote places belonging to the navy, where the ſhips of war, &c. are laid up in harbour. There are belonging to his majeſty's navy, ſix great yards, viz.—Chatham, Deptford, Woolwich, Portſmouth, Sheerneſs, and Plymouth; theſe yards are fitted with ſeveral docks, wharfs, launches, and graving places, for the building, repairing, and cleaning of his majeſty's ſhips; and therein are lodged great quantities of timber, maſts, planks, anchors, and other materials: there are alſo convenient ſtore-houſes in each yard, in which are laid up vaſt quantities of cables, rigging, ſails, blocks, and all other ſorts of ſtores, needful for the royal navy.

YARE, among ſailors, implies ready or quick: as, be yare at the helm; that is, be quick, ready, and expeditious at the helm. It is ſometimes alſo uſed for bright by ſeamen: as, to keep his arms yare; that is, to keep them clean and bright.

YARN, wool, or flax, ſpun into thread, of which they weave cloth. See CLOTH, WOOL, &c.

YAW

Yarn is ordered after the following manner: after it has been ſpun upon ſpindles, ſpools, or the like, they reel it upon reels, which are hardly two feet in length, and have but two contrary croſs-bars, being the beſt, and the leaſt liable to ravelling. In reeling of fine yarn, the better to keep it from ravelling, you muſt, as it is reeled, with a tye-band of big-twiſt, divide the ſlipping or ſkain into ſeveral leys, allowing to every ley eighty threads, and twenty leys to every ſlipping, if the yarn is very fine; otherwiſe leſs of both kinds. The yarn being ſpun, reeled, and in the ſlippings, the next thing is to ſcour it. In order to fetch out the ſpots, it ſhould be laid in lukewarm water for three or four days, each day ſhifting it once, wringing it out, and laying it in another water of the ſame nature: then carry it to a well or brook, and rinſe it till nothing comes from it but pure clean water: that done, take a bucking-tub, and cover the bottom thereof with very fine aſhen aſhes; and then having opened and ſpread the ſlippings, covering them with aſhes as before; and thus lay one upon another, till all the yarn be put in: afterwards cover the uppermoſt yarn with a bucking cloth, and in proportion to the bigneſs of the tub, lay therein a peck or two more of aſhes: this done, pour upon the uppermoſt cloth a great deal of warm water, till the tub can receive no more, and let it ſtand ſo all night. Next morning you are to ſet a kettle of clean water on the fire; and when it is warm, pull out the ſpiggot of the bucking-tub, to let the water run out of it, into another clean veſſel; as the bucking-tub waſtes, fill it up again with the warm water on the fire: and as the water on the fire waſtes, ſo likewiſe fill that up with the ley that comes from the bucking-tub; ever obſerving to make the ley hotter and hotter, till it boils: then you muſt, as before, ply it with the boiling ley at leaſt four hours together, which is called the driving of a buck of yarn. See BLEACHING.

YARRINGLE, a kind of inſtrument, or reel on which hanks of yarn are wound, to clues or balls. See REEL.

YAWNING, *Oſcitatio*, an involuntary opening of the mouth, occaſioned by a vapour, or ventoſity, endeavouring to eſcape, and generally witneſſing an irkſome wearineſs, or an inclination to ſleep.

Yawning, according to Boerhaave, is performed by expanding, at one and the ſame time, all the muſcles capable of ſpontaneous motion; by greatly extending the lungs; by drawing in gradually and ſlowly a large quantity of air, and gradually and ſlowly breathing it out, after it has been retained for ſome time, and rarified, and then reſtoring the muſcles to their natural ſtate. Hence, the effect of yawning is to move, accelerate, and equally diſtribute all the humours through all the veſſels of the body, and, conſequently, to qualify the muſcles and organs of ſenſation for their various functions.

Sanctorius obſerves, that a great deal is inſenſibly diſcharged, when nature endeavours to get rid of the retained perſpirable matter, by yawning and ſtretching of the limbs. To theſe a perſon is moſt inclined juſt after ſleep, becauſe a greater quantity going off by the pores of the ſkin, than at other times, whenſoever a perſon wakes,

wakes, the increaſed contraction that then happens, cloſes a great deal of the perſpirable matter in the cutaneous paſſages, which will continually give ſuch irritations, as excite yawning and ſtretching; and ſuch motions, by ſhaking the membranes of the whole body, and ſhifting the contacts of their fibres and the incloſed matter, by degrees throw it off. Hence we ſee the reaſon, why healthful ſtrong people are moſt inclined to ſuch motions, becauſe they perſpire moſt in time of ſleep, and therefore have more of the perſpirable matter to lodge in the pores, and greater irritations thereunto.

YAWS, in the ſea-language. A ſhip is ſaid to make yaws when ſhe does not ſteer ſteady, but goes in and out when there is a ſtiff gale.

YAWS, a diſtemper endemial to Guinea and the hotter climates in Africa.

It makes its firſt appearance in little ſpots on the cuticle, not bigger than a pin's point, which increaſe daily, and become protuberant, like pimples. Soon after, the cuticle frets off; and then, inſtead of pus or ichor, there appears white ſloughs or ſordes, under which is a ſmall red fungus. Theſe increaſe gradually, ſome to the ſize of a ſmall wood-ſtrawberry, others to that of a raſpberry; others again exceed the largeſt mulberry, which in ſhape they very much reſemble. In the mean time, the black hair growing in the yaws turns to a tranſparent white. See CUTICLE, &c.

It is not eaſy to determine the exact time which the yaws take in going through their different ſtages. Luſty well fed negroes have had ſeveral yaws as big as a mulberry in a month's time; whereas the low in fleſh, with a ſcanty allowance, have paſſed three months without their growing to the ſize of a ſtrawberry.

They appear in all parts of the body, but are moſt plentiful, and of the largeſt ſize, about the groin, privy parts, anus, arm-pits, and face; they are largeſt when feweſt in number, and *vice verſa*. They are not painful, unleſs handled roughly, nor cauſe a loſs of appetite. They continue long without any ſenſible alteration; and ſome are of opinion, that as ſoon as the funguſes become dry, the infection is exhauſted.

The yaws are not dangerous, if the cure is ſkilfully managed at a proper time. But if the patient has been once ſalivated, or has taken any quantity of mercury, and his ſkin once cleared thereby, the cure will be very difficult, if not impracticable. The following form of medicine is recommended as a cure: Take of flowers of ſulphur, one ſcruple; of camphor diſſolved in ſpirit of wine, five grains; of theriaca Andromachi, one dram; and as much ſyrup of ſaffron as will make a bolus. Let the bolus be taken at going to reſt, which muſt be repeated for a fortnight or three weeks, till the yaws come to the height. Then throw the patient into a gentle ſalivation, with calomel given in ſmall doſes, without farther preparation. After ſalivation, ſweat the patient twice or thrice, on a frame or chair, with ſpirit of wine, and give the following electuary: of æthiops mineral, one ounce and a half; of gum guaiacum, half an ounce; theriaca andromachi, and conſerve of red roſes, of each one ounce; oil of ſaſſafras, twenty drops; and as much of ſyrup of ſaffron as is requiſite for an electuary. Of this, let two drams be taken in the morning and at night. He may likewiſe drink the decoction of guaiacum and ſaſſafras fermented with molaſſes, for his conſtant drink, while the electuary is taking, and a week or a fortnight after the electuary is ſpent.

Sometimes there remains one large yaw, high and knobbed, red and moiſt; this is called the maſter-yaw. This muſt be conſumed an eighth or a tenth part of an inch below the ſkin, with corroſive red mercury, and burnt alum, of each an equal quantity; and digeſted with one ounce of yellow baſilicon, and one dram of red corroſive mercury; and cicatrized with lint preſſed out of ſpirit of wine, and with the vitriol ſtone.

YEAR, *Annus*, the time the ſun takes to go through the twelve ſigns of the zodiac. This is properly the natural or tropical year, and contains 365 days, 5 hours, and 49 minutes. See the articles SIGN and ZODIAC.

As for the Gregorian, the civil, the ſolar or aſtronomical, the biſſextile, and Platonic years, ſee them under the articles GREGORIAN, CIVIL, &c.

The Julian year derives both its name and inſtitution from Julius Cæſar the dictator; for before his time the form of the Roman year was ſo corrupted by the indiſcretion of the pontiffs, in whoſe hands the power of intercalation was lodged, that the winter-months fell back to the autumn, and thoſe of autumn to the ſummer. To remedy theſe inconveniences, the dictator not only added to that year, in which he ſet about the reformation of the calendar, the common intercalation of 23 days, between the 23d and 24th days of February, purſuant to Numa Pompilius's inſtitution, but likewiſe 67 days more between November and December; ſo that this year contained 445 days. This done, he inſtituted a ſolar year, of 365 days and 6 hours, purſuant to what he had learned from the Egyptians, and every fourth year he ordered a day to be added. See JULIAN PERIOD.

The Arabs, Saracens, and Turks, count their year by the motion of the moon, making it conſiſt of 12 moons, or months; whereof ſome have 30, and ſome 29 days, alternately; and theſe altogether make 354 days, and conſtitute a common lunar year: and 354 days, 8 hours, 48 minutes, 38 ſeconds, 12 thirds, conſtitute what is called a lunar aſtronomical year.

The Greeks counted their year by the motion of both ſun and moon; and finding that there was 11 days difference between the lunar and ſolar years, at firſt they added an intercalary month every two years, containing 22 days. Afterwards, conſidering the 6 hours alſo, they put their emboliſm off 4 years, and then making the 3 firſt years to contain 354 days each, this made the fourth year to have 399 days: and to make this intercalation the more remarkable, they inſtituted the Olympic games on every ſuch fourth year; whence came the computation by Olympiads. See OLYMPIAD.

The Egyptians had two ſorts of years, the erratic and the fixed, or actiac. The erratic was called the Nabonaſſarean, from the epocha which takes its riſe from Nabonaſſar, king of the Chaldees. As it neglects the 6 hours, which, in the Julian form, make a leap-day once in four years, its beginning anticipates the Julian every fourth year by a day, and therefore it is juſtly called erratic.

The anticipation of 1 day in 4 years, gains of the Julian years 1 in 1460; ſo that 1461 Nabonaſſarean years make but 1460 Julian years.

The fixed Egyptian year obſerves the Julian form of 365 days and 6 hours, making a leap-day of the 6 hours one in 4 years. It differs from the Julian in this, that its months are the ſame with thoſe of the Nabonaſſarean; that it begins on Auguſt 29, inſtead of January 1; or on Auguſt 30, if it be a leap-year; that it takes in the leap-day, not in February, but at the end of the year. See EPOCHA and INTERCALARY.

The Perſian erratic year goes by the name Yezdegerdic, by reaſon that the Perſian epocha commences from the death of Yezdegird, the laſt Perſian king, who was killed by the Saracens. It conſiſts of 12 months, containing 30 days each, and 5 ſupernumerary ones; ſo that it differs from the Nabonaſſarean only in the names of the months, and the commencement of the epocha.

The Gelalean year, uſed alſo by the Perſians, is very well adapted to the ſolar motions. It takes in a leap-day every fourth year, but every ſixth or ſeventh turn it throws it forward to the fifth year, by which means the equinoxes and ſolſtices are fixed to almoſt the ſame days of the month.

The Syriac year conſiſts of 365 days and 6 hours, being divided into 12 months of equal extent with thoſe of the Julian year, to which they correſpond. This year begins October 1, ſo that the month called Tiſhrim, agrees with our October. The aſtronomical year is two-fold, viz. the tropical and ſidereal; by the latter, is meant that ſpace of time which the ſun takes in departing from a fixed ſtar, and returning to the ſame again. This year conſiſts of 365 days, 6 hours, and 10 minutes.

As the form of the year is various among different nations, ſo likewiſe is the beginning: the Jews began their eccleſiaſtical year with the new moon of that month whoſe full moon happens next after the vernal equinox; and every ſeventh year they kept as a ſabbatic year, during

ing which they let their land lie at reſt. The ancient Jewiſh year was made to agree with the ſolar year, by the adding of 11, and ſometimes of 12 days, at the end of the year, or by an emboliſmic month.

The beginning of the Athenian or Attic year, was reckoned from that new moon, the full moon of which comes next after the ſummer ſolſtice.

The Macedonian lunar year agrees with the Athenian, excepting that the former takes its beginning, not from the ſummer-ſolſtice, but from the autumnal equinox.

The Ethiopic year is a ſolar year, agreeing with the actiac or fixed Egyptian year, except in this, that the names of the months are different, and that it commences, with the Egyptian year, on Aug. 29, of the Julian year.

The Arabian or Mahometan year is called alſo that of the hegira, becauſe the calculation of theſe years runs from the epocha of the hegira, when Mahomet fled from Mecca to Medina: they had twelve civil months in a year, which contained 29 and 30 days, by turns, abating for their leap years, in which the month Dultreggia has always 30. See HEGIRA.

The Mahometans begin their year when the ſun enters Aries; the Perſians, in the month anſwering to our June; the Chineſe, and moſt of the Indians, begin it with the firſt moon in March: at Rome there are two ways of computing the year, the one beginning at the nativity of our Lord, which the notaries uſe; the other in March, on occaſion of the incarnation, and it is from this the bulls are dated. The civil or legal year, in England, as well as the hiſtorical year, commences Jan. 1, by the late act for the alteration of the ſtyle: the church, as to her ſolemn ſervice, begins the year on the firſt Sunday in Advent, which is always that next St. Andrew's day.

YEAR AND DAY, in law, ſignifies a certain time that by law determines a right, or works preſcription in divers caſes; as in the caſe of an eſtray, if the owner do not challenge it within that time, it becomes forfeited to the lord; ſo of a wreck, &c. The like time is given to proſecute appeals in; and where a perſon wounded, dies in a year and a day after the wound received, it makes the offender guilty of murder.

YELLOW, one of the original colours of light. See COLOUR and LIGHT.

YELLOW, in dyeing, is one of the five ſimple and mother colours.

For the fineſt yellows, they firſt boil the cloth or ſtuff in alum or pot-aſhes, and give the colour with weld or wold.

Likewiſe turmeric gives a good yellow, though not the beſt.

There is alſo an Indian wood, that gives a yellow colour bordering on gold. There is another ſort of yellow, made of ſavory; but this is inferior to them all.

With yellow, red of madder, and that of goat's hair prepared with madder, are made the gold yellow, aurora, thought-colour, macarate, iſabella, chamoiſe-colour, which are all caſts or ſhades of yellow. Painters or enamellers make their yellow of maſticote, which is ceruſs raiſed to a yellow colour by the fire, or with oker. Limners and colourers make it with ſaffron, French berries, orcanette, &c. Mr. Boyle tells us a moſt beautiful yellow may be procured by taking good quick ſilver, and three or four times its weight of oil of vitriol, and drawing off, in a glaſs retort, the ſaline menſtruum from the metalline liquor, till there remains a dry ſnow-white calx at the bottom: on pouring a large quantity of fair water on this, the colour changes to an excellent light yellow.

He ſays, he fears this colour is too coſtly to be uſed by painters: and he does not know how it would agree with every pigment, eſpecially oil colours.

YELLOWS, a diſeaſe in a horſe, much the ſame with that called the jaundice in man.

There are two kinds of it, the yellow and the black. The yellow is a very frequent diſorder, ſay the farriers, ariſing from obſtructions in the gall-pipe, or the little ducts opening into the ſame, occaſioned by viſcid or gritty matter lodged therein, or a plenitude and compreſſion of the neighbouring blood-veſſels, by means of which the matter that ſhould be turned into gall, is taken up by the vein, and carried into the maſs of blood, which it tinctures yellow; ſo that the eyes, inſide of the lips, and other parts of the mouth capable of ſhewing the colour, appear yellow. The effect whereof is, that a horſe will be dull, heavy, and low ſpirited, eaſily jaded by the leaſt labour or exerciſe, &c.

The black is known by other ſymptoms: the whites of the eyes, mouth, and lips turn to a duſky colour, and are not ſo clear and ſanguine as before.

For the cure of this diſeaſe, we are directed to diſſolve an ounce of mithridate in a quart of ale, or beer, and give it the horſe lukewarm; or inſtead of mithridate, two ounces of Venice-treacle; and if that is not to be had, three ſpoonfuls of common treacle.

This diſtemper is alſo incident to black cattle. The cure is to bleed them in the ears, eyes, and in the tail; to put ſalt into their ears, and to rub them between your hands: and being blooded, give them two handfulls of ſalt down their throats, dry over night. In the morning let them have fenugreek, turmeric, long-pepper, aniſeed, and liquorice, but two pennyworth in all, made into a powder, and given in a quart of ale milk-warm.

YEOMAN, the firſt or higheſt degree among the plebeians of England, next in order to the gentry.

The yeomen are properly freeholders, who having land of their own, live on good huſbandry.

YEOMAN is alſo a title of office in the king's houſehold, of a middle place or rank between an uſher and a groom.

YEOMEN *of the Guard* were anciently two hundred and fifty men of the beſt rank under gentry, and of larger ſtature than ordinary, each being required to be ſix feet high.

At preſent there are but one hundred yeomen in conſtant duty, and ſeventy more not in duty; and as any of the hundred dies, his place is ſupplied out of the ſeventy.

They go dreſſed after the manner of king Henry VIII's time. They formerly had diet as well as wages, when in waiting; but this was taken off in the reign of queen Anne.

YERKING, in the manege, is when a horſe ſtrikes with his legs, or flings and kicks back with his whole hind quarters, ſtretching out the two legs nearly together, and even to their full extent.

YEST, YEAST, or BARM, a head, or ſcum riſing upon beer or ale, while working or fermenting in the vat.

It is uſed for a leven or ferment in the baking of bread, as ſerving to ſwell or puff it up very conſiderably in a little time, and to make it much lighter, ſofter, and more delicate. When there is too much of it, it renders the bread bitter.

The faculty of medicine of Paris, by a decree of March 24, 1688, ſolemnly maintained it noxious to the health of the people: yet could not that prevent its progreſs.

YEW, *Taxus*, in botany. See TAXUS.

YEW, is alſo a term uſed by the ſalt-workers of Lymington, and ſome other parts of England, to expreſs the firſt riſing of a ſcum upon the brine in boiling. See SALT.

YIELD, or SLACK *the hand*, in the manege, is to ſlack the bridle, and give the horſe head.

YNCA, or INCA, an appellation anciently given to the kings of Peru, and princes of the blood; the word literally ſignifying lord, king, emperor, and royal blood.

YOAK, or YOKE, in agriculture, a frame of wood, fitted over the necks of oxen, whereby they are coupled together, and harneſſed to the plough.

The Romans made the enemies they ſubdued, paſs under the yoke, which they called *ſub jugum mittere*; that is, they made them paſs under a ſort of *furca patibulares*, or gallows, conſiſting of a pike, or other weapon, laid acroſs two others, planted upright in the ground.

Sea-YOAK.—When the ſea is ſo rough, that the helm cannot be governed by the hands, the ſeamen make a yoak to ſteer by; that is, they fix two blocks to the end of

of the helm, and reeving two ſmall ropes through them, which they call falls, by having ſome men at each tackle, they govern the helm by direction. They have another way of making a ſea-yoak, by taking a double turn about the end of the helm with a ſingle rope, the ends being laid to the ſhip's ſides, by means of which they guide the helm.

YOLK, or YELK, in natural hiſtory, the yellow part in the middle of the egg.

YOUTH, ſee the article ADOLESCENCE.

YOUTH, *Juventus*, in the Pagan theology, a goddeſs worſhipped among the Romans, who, together with the gods Mars and Terminus, kept her place in the capitol along with Jupiter, when the other deities were turned out; whence the Romans drew a lucky omen for the durableneſs of their empire.

YPSILOIDES, in anatomy, the third genuine ſuture of the cranium, thus called from its reſembling a Greek *υ*, or ypſilon.

YUCCA, in botany, a genus of plants, whoſe flower is campanulated, and divided into ſix large ovate petals, cohering at their baſe: the ſtamina are ſix ſhort filaments, topped with ſmall antheræ: the fruit is an oblong trifid capſule, obtuſely triangular, and divided into three cells, which contain many ſeeds laying over each other in a double order.

The yucca has much the appearance of the aloe, and is propagated in the ſame manner; and from the dried root of a ſpecies, a kind of bread is made by the Indians.

Z.

ZAI ZEA

Z, The twenty fourth and laſt letter, and the nineteenth conſonant of our alphabet; the ſound of which is formed by a motion of the tongue from the palate downwards and upwards to it again, with a ſhutting and opening of the teeth at the ſame time.

This letter has been reputed a double conſonant, having the ſound *ds*; but ſome think with very little reaſon; and, as if we thought otherwiſe, we often double it, as in *puzzle*, *muzzle*, &c.

Among the ancients Z was a numeral letter, ſignifying two thouſand; and with a daſh at top, $\overline{Z}$ ſignified two thouſand times two thouſand, or four millions.

In abbreviations, this letter formerly ſtood as a mark for ſeveral ſorts of weights; ſometimes it ſignified an ounce and a half, and very frequently it ſtood for half an ounce; ſometimes for the eighth part of an ounce, or a dram troy weight; and it was in the earlier times uſed to expreſs the third part of one ounce, or eight ſcruples. ZZ were uſed by ſome of the ancient phyſicians to expreſs myrrh, and at preſent they are often uſed to ſignify zinziber, or ginger.

ZAFFER, or ZAFFRE, in chemiſtry, the name of a blue ſubſtance, of the hardneſs and form of a ſtone; and generally ſuppoſed to be a native foſſil.

It is in reality, however, a preparation of cobalt; the calx of that mineral being mixed with powdered flints, and wetted with water to bring it into this form. See COBALT.

To prepare this for uſe in the glaſs-trade, put it in the furnace; then put it into an iron ladle to be heated red-hot, and ſprinkle it with ſtrong vinegar; and when cold, grind it on a porphyry to an impalpable powder; then throw this into water in glazed earthen pans; and when it has been well ſtirred about, let it ſettle, and pour off the water: repeat this waſhing often, and the foulneſs of the zaffre will be thus wholly ſeparated: dry the powder, and keep it for uſe.

ZAIRAGIA, a kind of divination in uſe among the Arabs, performed by means of divers wheels or circles placed concentric to one another, and noted with ſeveral letters, which are brought to anſwer to each other by moving the circles according to certain rules.

ZANNICHELLIA, in botany, a genus of plants, producing male and female flowers; the male flower hath neither cup or corolla, conſiſting only of a long, erect, ſingle filament, topped with an ovate anthera; the female flower, which is placed near the filament, has no corolla, but conſiſts of a monophyllous ventricoſe cup, which is ſcarce viſible, and four corniculated germina, which join together, and afterwards become the ſame number of oblong ſeeds, which are acuminated on both ſides.

ZANONIA, in botany, a genus producing male and female flowers on diſtinct plants; the male flower is monopetalous, and *divided into three pointed* inflexed ſegments, with five patent ſtamina; the corolla of the female flower is like that of the male, and the fruit is a long, very large, truncated berry, attenuated at the baſe; it contains three cells, in each of which are placed two ſeeds, of an oblong-roundiſh figure.

ZAPATA, or SAPATA, a kind of feaſt or ceremony held in Italy, in the courts of certain princes, on St. Nicholas's day; wherein people hide preſents in the ſhoes or ſlippers of thoſe they would do honour to, in ſuch a manner as may ſurpriſe them on the morrow when they come to dreſs; being done in imitation of St. Nicholas, who uſed, in the night-time, to throw purſes of money in at the windows, to marry poor maids withal.

ZEA, Indian corn, in botany, a genus of plants, producing male and female flowers in ſpikes; the corolla of the male flower is a bivalvular glume, with two compreſſed very ſhort nectaria: the ſtamina are three capillary filaments, topped with quadrangular antheræ; the corolla of the female flower conſiſts of two membranaceous, broad, perſiſtent valves: there is no pericarpium; but the ſeeds, which are roundiſh, and compreſſed, are half incloſed in a large long receptacle.

ZEAL, ζηλος, the exerciſe of a warm animated affection, or paſſion, for any thing. See the article PASSION.

ZEALOTS, an ancient ſect of the Jews, ſo called from their pretended zeal for God's laws, and the honour of religion. The Zealots were a moſt outrageous and ungovernable people; and on pretence of aſſerting God's laws, and a ſtrictneſs and purity of religion, aſſumed a liberty of queſtioning notorious offenders without ſtaying for the ordinary formalities of law.

ZEBRA, the wild aſs, in zoology, a ſpecies of equus, tranſverſely ſtriated.

It is an extremely beautiful animal, and though in colouring ſo much different from all other kinds and varieties of equus, agrees with it in all other reſpects: it is about equal to the common aſs in ſize, but of a much more elegant figure; the head is ſmall and ſhort, the ears are long, the eyes are large and bright, and the mouth conſiderably large; the neck is long and ſlender, but elegantly turned; the body is rounded, and ſmall in compariſon of that of the common aſs; the legs are long and ſlender, the tail long and beautiful, but hairy only at the end.

The whole animal is party-coloured, or beautifully ſtriped in a tranſverſe direction, with long and broad ſtreaks, alternately of a deep, gloſſy, and ſhining browniſh and whitiſh, with ſome abſolutely black. It is a native of many parts of the Eaſt.

ZECHARIAH, a canonical book of the Old Teſtament, containing the predictions of Zechariah, the ſon of Barachia, and grandſon of Iddo. He is the eleventh of the twelve leſſer prophets.

Zechariah entered upon the prophetic office at the ſame time with Haggai, and was ſent to the Jews upon the ſame meſſage, to reprove them for their backwardneſs in erecting the temple, and reſtoring divine worſhip; but eſpecially for the diſorder of their lives and manners, which could not but derive a curſe upon them. By ſeveral notable viſions and types, he endeavours to confirm their faith, and eſtabliſh their aſſurance concerning God's providence with them, and care over them; and as a proof and demonſtration of this, he interſperſes the moſt comfortable promiſes of the coming of the kingdom, the temple, the prieſthood, the victory, the glory of Chriſt the Branch. Nor does he forget to aſſure them of the ruin of Babylon, their moſt implacable enemy. This prophet is the longeſt and moſt obſcure of all the leſſer prophets, his ſtyle being interrupted and without connection.

ZEDOARY, in the materia medica, a root, the ſeveral pieces of which differ ſo much from one another in ſhape, that they have been divided into two kinds, as if two different things, under the names of the long and round zedoary, being only the ſeveral parts of the ſame root.

The long pieces of zedoary are of a very ſingular figure; they are not of the nature of the common long roots of plants, but are, themſelves, properly tubera or glandules, as well as the round ones, differing from them in nothing but their oblong figure: they are two, three or four inches in length, and of the thickneſs of a man's finger; not large at one end, and tapering away to the other, but thickeſt in the middle, and growing gradually ſmaller to each end, where they terminate in an obtuſe point each way: they are of a tolerable ſmooth ſurface, except that they have ſome little protuberances in ſeveral parts from which fibres have originally grown: they are of a very cloſe and compact texture, conſiderably heavy, and very hard; they will not cut eaſily with a knife; when cut, they ſhew a fine, ſmooth, and gloſſy ſurface; they are of a pale greyiſh colour on the outſide, with a faint mixture of brown, and are of a dead whitiſh hue within: they are not eaſily powdered in the mortar; their ſmell, while bruiſing, is very remarkable, and is highly aromatic, and of a bitteriſh taſte. The round zedoary has all the ſame characters with this, and differs only in figure, being ſhort and roundiſh, of the ſize of a ſmall walnut, ſmooth on the ſurface, except where the bundles of fibres have adhered, and generally running into a ſharp point at the end.

Zedoary is to be choſen freſh, ſound, and hard, in large pieces; it matters not as to ſhape, whether long or round; of a ſmooth ſurface, and of a ſort of fatty appearance within, too hard to be bittten by the teeth, and of the briſkeſt ſmell that may be; ſuch as is friable, duſty, and worm-eaten, is to be rejected.

The ancient Greeks were wholly unacquainted with zedoary; there is no mention of any ſuch drug in the works of Dioſcorides or Galen. The Arabians, however, were well acquainted with it; they mention it ſometimes under the name of zedoary, and ſometimes under that of zerumbeth; but are ſo ſhort in their deſcriptions, and ſo at variance among one another, that it is not eaſy to aſcertain their meaning, as to the diſtinction, if they originally meant any, between the ſubſtances expreſſed by theſe two names.

Serapio and Rhazes uſe the words zedoaria and zerumbeth as ſynonymous, and declare both to mean only the ſame root. Avicenna, on the contrary, diſtinguiſhes the zedoary and zerumbeth, and even talks of two kinds of zedoary. Others of them make the zarnab they ſpeak of different both from the zedoary and zerumbeth; but Serapio, an author as much to be depended upon for his accuracy as any of them, declares zedoary, zerumbeth, and zarnab, all to be the ſame thing.

Zedoary both of the long and round kind, is brought us from China; and we find by the Arabians, that they alſo had it from the ſame place. The round tubera are leſs frequent than the long, and ſome of them have, therefore, ſuppoſed them the produce of a different and more rare plant; but this is not ſo probable as that the general form of the root is long, and the round tubera are only luſus naturæ, and leſs frequent in it.

The plant which produces it, is one of the claſs of the herbæ bulboſis affines of Mr. Ray. It is deſcribed in the *Hortus Malabaricus*, under the name malan kua. Zedoary, diſtilled with common water, affords a thick and denſe eſſential oil, which ſoon concretes of itſelf into a kind of camphor, and on this oil its virtues principally depend. It is a ſudorific, and is much recommended by ſome in fevers, eſpecially of the malignant kinds. It is alſo given with ſucceſs as an expectorant in all diſorders of the breaſt ariſing from a tough phlegm, which it powerfully incides and attenuates; it is alſo good againſt flatulencies, and in the cholic; it ſtrengthens the ſtomach, and aſſiſts digeſtion; and, finally, is given with ſucceſs in nervous caſes of all kinds.

ZEND, or ZENDAVESTA, a book containing the religion of the magicians, or worſhippers of fire, who were diſciples of the famous Zoroaſter.

This book was compoſed by Zoroaſter during his retirement in a cave, and contained all the pretended revelations of that impoſtor. The firſt part contains the liturgy of the magi, which is uſed among them in all their oratories and fire temples to this day; they reverence it as the Chriſtians do the bible, and the Mahometans the Koran. There are found many things in the zend taken out of the ſcriptures of the Old Teſtament, which Dr. Prideaux thinks is an argument that Zoroaſter was originally a Jew. Great part of the pſalms of David are inſerted in the zend; he makes Adam and Eve to have been the firſt parents of mankind, and gives the ſame hiſtory of the creation and deluge as Moſes does, and commands the ſame obſervances about clean and unclean beaſts, the ſame law of paying tythes to the ſacerdotal order, with many other inſtitutions of Jewiſh extraction. The reſt of its contents are an hiſtorical account of the life, actions, and prophecies of its author, with rules and exhortations to moral living. The Mahometans have a ſect which they call Zendikites, who are ſaid to be the Sadducees of Mahometaniſm, denying Providence and the reſurrection, believing the tranſmigration of ſouls, and following the zend of the magi.

ZENITH, in aſtronomy, the vertical point; or a point in the heavens directly over our heads.

The zenith is called the pole of the horizon, becauſe it is ninety degrees diſtant from every point of that circle.

ZENITH DISTANCE, is the complement of the meridian altitude of any heavenly object: or it is the remainder, when the meridian altitude is ſubtracted from ninety degrees.

ZENSUS, in arithmetic, a name given to a ſquare number, or the ſecond power, by ſome authors.

ZEPHANIAH, a canonical book of the Old Teſtament, containing the predictions of Zephaniah the ſon of Cuſhi, and grandſon of Gedaliah; being the ninth of the twelve leſſer prophets. He propheſied in the time of king Joſiah, a little after the captivity of the ten tribes, and before that of Judah; ſo that he was cotemporary with Jeremiah.

ZEPHYR,

ZEPHYR, *Zephyrus*, the weſt wind; or that which blows from the cardinal point of the horizon oppoſite the eaſt.

ZEST, the woody thick ſkin, quartering the kernel of a walnut; preſcribed by ſome phyſicians, when dried and taken with white-wine, as a remedy againſt the gravel.

ZEST is alſo uſed for a chip of orange or lemon-peel; ſuch as is uſually ſqueezed into ale, wine, &c. to give it a flavour: or the fine ethereal oil which ſpurts out of that peel on ſqueezing it.

ZETETIC METHOD, in mathematics, the method made uſe of to inveſtigate or ſolve a problem.

ZEUGMA, a figure in grammar, whereby an adjective or verb which agrees with a nearer word, is alſo, by way of ſupplement, referred to another more remote.

ZIBETHICUS, the civet-cat, in zoology, the grey meles, with uniform claws. It was long before the form of this creature, to whom we owe the civet, was known: and long after this before it could be determined to what genus of quadrupeds it belonged: it was firſt ſuppoſed of the cat, and afterwards of the dog-kind; but it is truly one of the badger ſpecies. It is a large and fierce animal; its ſize is that of the common badger, but its body is not ſo bulky; the head is large, oblong, and conſiderably thick; the fore-head is depreſſed; the ſnout is rounded and thick; the noſe turns up a little; the mouth is wide, and is furniſhed in a very formidable manner with teeth; and there are a few rigid but very long whiſkers about it; the eyes are ſmall, the ears large, obtuſe, and patulous; the neck is long, rigid, and thick; the tail long, and reſembling that of the common cat; it is covered with hair, and there runs a ridge of the ſame hair all along the top of the back. The whole animal is of a light ſilvery colour, variegated in a beautiful manner with large ſpots of black; the legs are very robuſt, almoſt entirely black; the feet are armed with very long and ſharp claws; under the tail is ſituated the bag, in which is contained the perfume we call civet; and its ſituation is the ſame with that which contains the white ſebaceous matter in the badger.

ZIBETHUM, *Civet*. See CIVET.

ZIMENT-WATER, or copper water, in natural hiſtory, the name by which ſome have called water found in places where there are copper-mines, and lightly impregnated with particles of that metal. See COPPER.

The moſt famous ſpring of this kind is a mile diſtant from Newſol, in Hungary, in a great copper-mine, where the water is found at different depths, and is received into different baſons, for the purpoſe of ſeparating the copper from it. In ſome of theſe it is much more highly ſated with this metal than in others, and will make the ſuppoſed change of iron into that metal much ſooner. The moſt common pieces of iron uſed in the experiments, are horſe-ſhoes, nails, and the like; they are found very little altered in ſhape after the operation, except that their ſurfaces are more raiſed. The water which performs this wonderful operation appears greeniſh in the baſons where it ſtands; but if a glaſs of it be taken up, it looks clear as cryſtal; it has no ſmell, but has a very ſtrong vitriolic and aſtringent taſte, inſomuch that the lips and tongue are bliſtered and ſcorched on taſting it. The miners uſe this water as a medicine; and whatever ſickneſs they are ſeized with, they firſt attempt its cure with large doſes of this water, which uſually both vomits and purges them briſkly; they alſo uſe it in diſorders of the eyes. The copper produced from theſe waters is valued by the people much beyond any other copper, as being more ductile, and running eaſier in the fire. And from the ſeveral experiments made upon the water, the true nature of it may be eaſily underſtood. It contains a large quantity of the vitriol of copper, which it probably owes to a ſolution of that metal, by means of the acid of the common pyrites and water. When this is known, the effects are not difficult to be accounted for; there being no real change of one metal into another, but the true ſtate of the caſe being that the particles of one metal are diſſolved and carried away, and thoſe of another metal depoſited in their place; a water thus impregnated is a menſtruum capable of diſſolving iron, and in the ſolution of that metal becomes ſo weakened as to let go the copper it before contained in ſmall parcels.

ZINK, ZINC, or ZINCK, in natural hiſtory, the name of a very remarkable foſſil ſubſtance, reſembling biſmuth in appearance, but of a bluer colour. See the article BISMUTH.

It is a very remarkable mineral, and one that has never been well underſtood as to its origin, till of late; for though the world well knew of a long time both zink and lapis calaminaris, and knew that both of them had the remarkable property of turning copper into braſs, which one would think might have given a hint to the diſcovery of a natural alliance between them; yet have they been ever treated of as two different ſubſtances, by the writers on theſe ſubjects; and Dr. Lawſon was the firſt who ever publickly declared, and proved, lapis calaminaris to be the ore of zink.

Zink is generally confounded with biſmuth, though in reality a very different body; but the regulus of theſe two minerals having a very great external reſemblance, the vulgar have not diſtinguiſhed them; and hence we hear of many ores of zink in the leſs accurate writers, all which are truly the ores of biſmuth.

The lapis calaminaris is the true and general ore of zink, yet that mineral is not confined to this ore alone, but is mixed in great abundance in its diſſeminated particles among the matter of the ores of other metals, particularly of lead.

Our artificers have long been acquainted with zink, under the name of ſpelter; but none of them till of late have ever been able to make any gueſs as to its origin. We have much zink brought to us from the Eaſt-Indies, under the name of tutenag; yet no body ever knew from what, or how it was produced there; and all that was heretofore known of it was, that among that ſtrange mixture of ores which the great mines yield at Goſſelaer in Saxony, when they were fuſed for other metals, a large quantity of zink was produced; but Dr. Lawſon obſerving, that the flowers of zink and of lapis calaminaris were the ſame, and that their effects on copper were the ſame, never ceaſed his inquiries till he found out the method of ſeparating zink from it.

The pure zink is a ſolid metal-like body, of a bluiſh white, and ſomewhat leſs brittle than biſmuth, eſpecially when gently heated, and moſt, of all the metallic minerals, approaches to malleability: it melts in a very ſmall fire, and in a ſtrong one takes fire, burning with a bluiſh green flame, and ſubliming into white flowers, which are with difficulty reducible again into the form of zink: in an open fierce fire, it wholly flies off in vapour.

There is great reaſon to believe, that all the zink or tutenag brought from the Eaſt-Indies, is procured from calamine; and we have now on foot at home, a work eſtabliſhed by the diſcoverer of this ore, which will probably make it very ſoon unneceſſary to bring any zink into England, as we have great plenty of the calamine.

The manner of extracting zink from the lapis calaminaris, is this: the lapis calaminaris muſt be finely pulverized, and well mixed with an eighth part of charcoal-duſt, and put into a cloſe retort to prevent the acceſs of air, which would inflame the zink as it riſes. The retort is to be placed on a violent fire, ſufficient to melt copper. After ſome time the zink riſes, and appears in the form of metallic drops within the neck of the retort. When the veſſel is cool, it muſt be taken out, by breaking off the neck of the retort.

Flowers of ZINK. The flowers of zink are a ſubſtance famous in the writings of the chemiſts, who have led their followers into a thouſand errors by the names by which they have called them.

The moſt ſimple and eaſy way of obtaining the flowers of zink pure and white, is this: melt the zink in a tall crucible inclined in the furnace in an angle of 45 degrees, or thereabouts; let the fire be moderate, little ſtronger than would be neceſſary for the melting of lead. If the zink is left in this ſtate without being ſtirred, it forms a grey cruſt upon its ſurface, and becomes calcined by degrees under it into a granuloſe white ſubſtance; but to have the flowers, the matter muſt be ſtirred from time to time with an iron rod, and this cruſt broken as often as

it ariſes; there will then, after ſome time, appear a bright white flame; and about two inches above it there will be found a very thick ſmoak, and with this there will ariſe a quantity of very white flowers, which will fix themſelves to the ſides of the crucible in the form of fine cotton.

The fumes of zink have a ſtrong ſmell of garlic, and are very noxious to the lungs. The reducing zink into theſe flowers, is the deſtroying it abſolutely as to its metallic form; for none of the methods uſed by chemiſts to bring back metals to their original ſtate, are able to bring theſe flowers to zink again.

ZOCCO, Zoccolo, Zocle, or Socle, in architecture, a kind of ſtand or pedeſtal, being a low ſquare piece, or member, ſerving to ſupport a buſto, ſtatue, or the like thing that needs to be raiſed.

ZODIAC, *Zodiacus*, in aſtronomy, a faſcia or broad circle, whoſe middle is the ecliptic, and its extremes two circles, parallel thereto, at ſuch a diſtance from it, as to bound or comprehend the excurſions of the ſun and planets.

The ſun never deviates from the middle of the zodiac, i. e. from the ecliptic, but the planets all do more or leſs. Their greateſt deviations, called latitudes, are the meaſure of the breadth of the zodiac, which is broader or narrower, as the greateſt latitude of the planets is made more or leſs; accordingly, ſome make it ſixteen, ſome eighteen, and ſome twenty degrees broad.

The zodiac, cutting the equator obliquely, makes an angle therewith of 23° 29′, which is what we call the obliquity of the zodiac, and is the ſun's greateſt declination.

The zodiac is divided into twelve portions, called ſigns, and thoſe diviſions or ſigns are denominated from the conſtellations which anciently poſſeſſed each part; but the zodiac being immoveable, and the ſtars having a motion from weſt to eaſt, thoſe conſtellations no longer correſpond to their proper ſigns, whence ariſes what we call the preceſſion of the equinoxes.

When a ſtar therefore is ſaid to be in ſuch a ſign of the zodiac, it is not to be underſtood of that ſign or conſtellation of the firmament, but only of that twelfth part of the zodiac, or dodecatemory thereof.

Caſſini has alſo obſerved a track in the heavens, within whoſe bounds moſt of the comets, though not all of them, are obſerved to keep, which for this reaſon he calls the zodiac of the comets.

This he makes as broad as the other zodiac, and marks it with ſigns and conſtellations like that, as Antinous, Pegaſus, Andromeda, Taurus, Orion, the leſſer Dog, Hydra, the Centaur, Scorpion, and Sagittary.

ZONE, *ζωνη*, in geography and aſtronomy, a diviſion of the terraqueous globe, with reſpect to the different degrees of heat found in the different parts thereof.

A zone is the fifth part of the ſurface of the earth, contained between two parallels.

The zones are denominated torrid, frigid, and temperate.

The torrid zone is a faſcia, or band ſurrounding the terraqueous globe, and terminated by the two tropics. Its breadth is 46° 58′.

The equator, running through the middle of it, divides it into two equal parts, each containing 23° 29′. The ancients imagined the torrid zone uninhabitable.

The temperate zones are two faſciæ, or bands, enviroring the globe, and contained between the tropics and the polar circles: the breadth of each is 43° 2′.

The frigid zones are ſegments of the ſurface of the earth, terminated, one by the antarctic, and the other by the arctic circle; the breadth of each is 46° 58′.

ZOOLOGY, *ζωολογια*, the ſcience of animals. Artedi obſerves, that this makes one of the three kingdoms, as they are called, of natural hiſtory; the vegetable and the mineral being the two others: in theſe, however, there is this difference made by writers, that while vegetables and minerals are treated of together, as all of a piece in each, the ſubjects of zoology are divided; and it is made to compoſe, as it were, ſeveral kingdoms.

Whoever is to write on plants or minerals, calls his work a treatiſe of botany or mineralogy; and we have no words to expreſs any ſubdiviſion of them into kingdoms; but, in zoology, we treat, as different ſubjects, the different parts of it; and the hiſtory of birds is ſeparated, by ſome, from the reſt, under the name of ornithology; that of quadrupeds, under the name of tetrapodology; and we have for the reſt, the words entomology, amphibiology, and the like, expreſſing theſe things, which are properly but the parts of zoology, as ſo many diſtinct and ſeparate ſtudies.

ZOOPHORIC, or Zoophoric Column, is a ſtatuary column, or a column that bears and ſupports the figure of an animal.

ZOOPHORUS, or Zophorus, in the ancient architecture, the ſame with frieze in the modern.

ZOOPHYTON, or Zoophite, in natural hiſtory, a kind of intermediate body, partaking both of the nature of a ſenſitive and a vegetable. See the article Sensitive *Plant*.

ZOOTOMY, the art of diſſecting animals, or living creatures, being the ſame with anatomy, or rather comparative anatomy.

ZOPISSA, naval pitch, a kind of mixture of pitch and tar, ſcraped off ſhips that have been a long time at ſea.

This matter, by being gradually penetrated by the ſalt of the ſea, becomes partaker of its qualities, and being applied to the body externally, is found to be reſolutive and deſiccative.

ZOSTERA, in botany, a genus of plants, whoſe flower hath no corolla; the cup conſiſts of a plane linear ſpadix, and contains a great number of very ſhort filaments, topped with ovato-oblong antheræ; the pericarpium is membranaceous, and contains an ovate ſeed.

ZUINGLIANS, a branch of the ancient Chriſtian reformers, or proteſtants, ſo called from their author Huldric Zuinglius, a divine of Switzerland: who, ſoon after Luther had declared againſt the church of Rome, and being then miniſter of the church at Zurich, fell in with him, and preached openly againſt indulgences, the maſs, the celibacy of the clergy, &c.

ZYGÆNA, the ballance-fiſh, in ichthyology, a ſpecies of ſqualus, with a very broad, tranſverſe, hammer-like head.

This is one of the moſt extraordinary fiſh in the world; in its form, the general ſize is five or ſix feet, but it grows to be much larger. The head is the moſt extraordinary figure of that of any fiſh; it is not oblong, and running in a line with that of the body, but is placed tranſverſely, and has the appearance of the head of a hammer faſtened to its handle; the eyes are large, and placed at the two extremities; the mouth is tranſverſe, cut on the lower part of the head, and furniſhed with three or four rows of ſharp teeth; the noſtrils are ſmall, and not very conſpicuous, and the foramina at the eyes are oblong and large; the body is oblong and moderately thick; there are two back fins, and a pinna ani; the apertures of the gills are ten oblong ſlits, five on each ſide, running from juſt below the head towards the roots of the pectoral fins; the tail is divided into two parts, and the upper of theſe is much longer than the under.

ZYGOMA, in anatomy, a bone of the head, otherwiſe called os jugale, being no ſingle bone, but an union or aſſemblage of two proceſſes, or eminences of bones; the one from the os temporis, the other from the os malæ; theſe proceſſes are hence termed the zygomatic proceſſes, and the ſuture that joins them together, is denominated the zygomatic ſuture.

ZYGOMATICUS, in anatomy, a muſcle of the head, ariſing from the os zygoma, whence its name, and terminating at the angle of the lips. This muſcle, though uſually ſingle, is ſometimes double throughout; at other times it has a double head; ſometimes its tail only is bifid, and it is variouſly interwoven with the adjoining ones. See the preceding article.

ZYGOPHYLLUM, bean-capers, in botany, a genus of plants, the corolla whereof is compoſed of five petals,

petals, broadeſt at the top, obtuſe, emarginated, and larger than the cup; the nectarium conſiſts of ten convergent leaves, and includes the germen: the fruit is an oval pentagonal capſule, formed of five valves, containing five cells, with ſepta adhering to the valves: the ſeeds are numerous, roundiſh, and compreſſed: the figure of the fruit is ſubject to variation, and there is a ſpecies in which the parts of fructification are a fifth leſs.

ZYMOLOGY, in chemiſtry, is a term uſed by ſome writers, to expreſs a treatiſe on fermentation, or the doctrine of fermentation in general.

ZYMOSIMETER, an inſtrument propoſed by Swammerdam, wherewith to meaſure the degree of fermentation occaſioned by the mixture of different matters, and the degree of heat which thoſe matters acquire in fermenting; as alſo the heat or temperament of the blood of animals.

ZYTHOGALA, beer poſſet, a drink recommended by Sydenham, as good to be taken after a vomit, for allaying the acrimonious and diſagreeable taſte the vomit has occaſioned, as well as to prevent gripes.

ADDENDA ET CORRIGENDA.

ASTER, ſtarwort, a genus of plants producing a radiated flower, the diſk of which is compoſed of ſeveral funnel ſhaped hermaphrodite floſcules, which ſpread open at the top in five parts, and contain five capillary filaments, topped with cylindrical antheræ, with an oblong germen ſupporting a ſiliform ſtyle.

ATRIPLEX, orach, the name of a plant common in the hedges, eſteemed cooling and emollient, and its ſeeds, given internally, diuretic, and good in diſorders of the uterus.

In the article ATMOSPHERE, for 29 inches, read 29½ inches; and for 3980 pounds troy, read 31320 pounds.

AURICULA, bear's ear, the name of a very curious genus of flowers, of which there are ſeveral ſpecies.

Auriculas are propagated either by ſowing their ſeeds, or planting their off-ſets. In order therefore to obtain good flowers from ſeeds, choice muſt be made of the beſt flowers, which ſhould be expoſed to the open air, that they may enjoy the benefit of ſhowers, which is neceſſary to their producing good ſeeds. The time for ſowing thoſe ſeeds is from Auguſt to Chriſtmas; and the beſt ſoil for ſowing them in, is good freſh earth from a common, rather light, mixed with rotten dung and leaves, previouſly prepared. With this compoſt, the pots or tubs, in which the ſeeds are intended to be ſown, ſhould be filled. After levelling the ſurface very ſmooth, ſow the ſeeds thereon, and cover them very lightly with rotten mellow mould, taken out of the ſtems of decayed and hollow willow trees. The boxes or tubs ſhould be ſituated where they can only receive the morning ſun. In the following ſpring the young plants will come up, when they muſt be frequently refreſhed with water in dry weather till July, when they will be large enough to tranſplant; at which time, with the above preparation of earth, plant them in beds or boxes about three inches aſunder, ſhading them from the ſun in hot weather. After flowering, thoſe which appear to be valuable, ſhould be taken up and tranſplanted into pots of the ſmalleſt ſize; for if the pots are large, they will not thrive ſo well.

The method of propagating the auricula from ſlips or off-ſets is this: The ſlips ſhould be taken off in April when the old plants are in bloom, and planted in ſmall pots, in the ſame ſort of earth as before directed, and, during the ſummer ſeaſon, placed in a ſhady ſituation, and frequently refreſhed with water; but protected from the violent rains which fall in the autumn; and in winter very little wet ſhould fall on them, nothing being more prejudicial to auriculas in winter than wet. Nor ſhould they be too much expoſed to the ſun in the ſpring, which is apt to forward their flowering too ſoon, by which means the froſts in March will damage them, unleſs carefully protected.

DANIEL, the name of a canonical book of the Old Teſtament, written by a prophet of the ſame name, deſcended from the royal houſe of the kings of Judah, and contemporary with Ezekiel. The ſtile of Daniel is not ſo lofty and figurative as that of the other prophets: it is clear and conciſe, and his narrations and deſcriptions ſimple and natural. His prophecies concerning the coming of the Meſſiah, and the other great events of after-times, are ſo clear and explicit, that Porphyry objected to them, ſaying, they muſt have been written after the facts were done.

ERYGERON, groundſel, a genus of plants, with a compound flower, compoſed of many hermaphrodite florets, which form the diſk, and female half-florets, which make the rays, contained in one oblong ſcaly empalement. The hermaphrodite florets are funnel-ſhaped, have five ſtamina, and a ſmall germ crowned with long down ſitting on a naked receptacle.

GLECHOMA, ground-ivy, gill go by the ground, alehoof, or turnhoof; the name of a well known creeping plant, common in hedges and ſhady places. It is ſuppoſed to be particularly ſerviceable in diſorders of the breaſt, for cleanſing and healing ulcerations in general, reſolving coagulated juices, and purifying the blood.

GELDER ROSE, or GUELDER ROSE. See VIBURNUM.

HONEYSUCKLE. See the article LONICERA.

HOLYHOCK, *Alcea*, or *Vervain mallow*, ſee the article ALCEA.

HORNBEAM. See the article CARPINUS.

HORSEMANSHIP, the art of riding, breaking, diſciplining, and managing horſes.

Horſemanſhip, in its greateſt latitude, includes what relates to the knowledge of the make, colour, age, temper, and qualities of horſes; their reſpective countries and climates; with the manner of breeding, propagating, and diſcovering the uſes or ſervices they are moſt proper for; whether the wars, the race, the ſaddle, or labour.

But the word is more peculiarly underſtood of the art of riding; or of directing a horſe to advantage, not only in the ordinary motions, but more eſpecially in the managing, or making him work upon volts, airs, &c.

HYOSCIAMUS, henbane, the name of a plant with ſoft, hairy, oblong, notched leaves; and bell-ſhaped flowers, cut into four ſegments, followed by irregular cup-like capſules, whoſe cover falling off diſcloſes numerous ſmall ſeeds in two cells.

There are two ſpecies of henbane, diſtinguiſhed by the epithets of white and black. They are both ſtrongly narcotic and deleterious; ſo that they are uſed only in external applications, in which manner a cataplaſm of the leaves is ſaid to be refrigerant and diſcutient.

KIDNEY-BEAN, or FRENCH BEAN, *Phaſeolus*, in botany, a genus of plants, producing papilionaceous flowers; the vexillum is cordated, obtuſe, emarginated, and reclined, with reflexed ſides; the alæ are ovate, the ſame length as the vexillum, and ſtand upon long ungues; the carina is narrow, and revolves ſpirally, in a contrary direction to the ſun; the filaments are ten in number, nine of which are carinated and ſpiral, and topped with ſimple antheræ: the fruit is a long, ſtraight, coriaceous legumen, ending in an obtuſe point, containing oblong, compreſſed, kidney-ſhaped ſeeds.

ADDENDA ET CORRIGENDA.

There are ſeveral kinds of kidney-beans cultivated for culinary purpoſes; as the liver-coloured bean, the Batterſea-bean, the Canterbury dwarf-bean, the ſpeckled dwarf-bean, and thoſe which require ſupport; ſuch as the white and ſcarlet bloſſomed beans, &c.

French-beans are propagated from the ſeeds, and are generally planted in rows, at about three inches aſunder, and about an inch deep, excepting the larger ſorts, which ſhould have a greater diſtance. The firſt ſeaſon for ſowing them is about the latter end of April, and the laſt in July; but there ſhould be intermediate ſowings in May and June, to continue the ſupply of the table, as they will not laſt above three weeks in gathering, particularly in hot dry weather.

The uſe of kidney beans (or rather the pods) as a food, is ſo well known, as to be quite unneceſſary to mention it; they are opening, emollient, reſolvent, and promote urine, and they generally agree with moſt conſtitutions; the meal of the ſeed is ſometimes mixed in emollient cataplaſms.

LABURNUM, baſe tree trefoil, the name of a genus of plants, of which there are ſeveral ſpecies. It hath a butterfly flower. The ſtandard of the flower is ariſing, oval, and reflexed on the ſides. The wings are obtuſe, erect, and the length of the ſtandard. The heel is bellied and acute. It hath ten ſtamina, nine joined and one ſtanding ſeparate, and an oblong germen, which afterward becomes an oblong blunt pod, filled with kidney-ſhaped flat ſeeds.

LUNARIA, moon-wort, in botany, a genus of plants whoſe flower is tetrapetalous and cruciform; it hath ſix ſtamina, two of which are ſhorter than the reſt; the fruit is a large, erect, plane, compreſſed, elliptical pod, opening with two valves, and containing two cells, which incloſe a few compreſſed kidney-ſhaped ſeeds.

MANDRAKE, *Mandragora*, in botany, a genus of plants, whoſe flower hath one erect, bell-ſhaped petal, which is a little larger than the empalement. It has five awl-ſhaped ſtamina, which are arched and hairy at their baſe. In the center is ſituated a roundiſh germen, which afterwards turns to a large round berry with two cells, having on each ſide a fleſhy convex receptacle, filled with kidney-ſhaped ſeeds.

OROBANCHE, broom rape, in botany, a genus of plants, the corolla of which is monopetalous and ringent; and its fruit an oblong capſule formed of two valves, and containing a great many minute ſeeds.

PEA, *Piſum*, in botany, the name of a well known genus of plants, many ſorts of which are cultivated in gardens, and ſome in the open fields. They are generally ſown in rows, at about three feet aſunder, and four or five inches diſtant between the peas in each row. When the plants are come up, the earth ſhould be drawn up to their ſhanks with a hoe, and the ground kept entirely free from weeds: and when they are grown eight or ten inches high, ſome bruſh-wood ſhould be ſtuck into the ground cloſe to the peas, for them to ramp upon, which will ſupport them, and hinder their trailing upon the ground, whereby many of the larger ſorts rot in wet ſeaſons. Beſides, by thus ſupporting them, the air finds a free paſſage between them, which will preſerve the bloſſoms from falling off before their time, and occaſion them to bear much better, than if permitted to lie upon the ground. There will alſo, by this means, be room ſufficient to paſs between the rows to gather the peas when they are ripe.

PINGUICULA, butterwort, in botany, a genus of plants, whoſe flower is monopetalous and ringent, the longer lip of which is ſtrait, obtuſe, bifid and ſupine; the ſhorter lip is bifid, more obtuſe and ſpreading: it hath a corniculated nectarium, produced from the baſe of the petal: the ſtamina are only two cylindric curved filaments, topped with roundiſh antheræ; and the fruit is an oval capſule compreſſed at the top, having one cell, which contains many cylindrical ſeeds, with a looſe receptacle.

PLATINA, a metal found in the gold mines in the Weſt-Indies, but lately known in Europe.

It is brought over in ſmall white grains mixed with a ferrugineous ſand, and ſome other foreign matters. The Spaniards gave it the name of Platina, a diminutive of Plata, ſilver, probably from its colour; for in this reſpect it greatly reſembles ſilver, though in others it comes nearer to gold.

It poſſeſſes, in effect, almoſt all thoſe properties which have been hitherto ſuppoſed characteriſtic of gold, and ſtands all the teſts by which that metal has been uſually aſſayed or refined; being nearly as ponderous; equally diſſoluble in aqua regia, and precipitable by the other metals which diſſolve in that menſtruum: equally reſiſting aqua fortis, and the other ſimple acids, as well as the regal cement; being equally permanent and fixed in the fire; equally indiſtinctible by lead and biſmuth; unaffected by nitre and by ſulphur; incapable of being ſcorified by the ſulphureous part of antimony, or volatilized by its reguline.

This metal is in ſome degree malleable; but leſs ſo when ignited than when cold. Its ſpecific gravity is to that of gold nearly as 18 to 19.

PULEGIUM, pennyroyal, the name of a plant of the mint kind, differing from the mints ſtrictly ſo called, in the flowers being diſpoſed, not in ſpikes on the tops, but in thick cluſters, at diſtances, round the joints of the ſtalks; and the upper ſegment of the flower not being nipped at the extremity.

Pennyroyal is a warm pungent herb, a good carminative and deobſtruent in hyſteric caſes, and diſorders of the breaſt.

PYROMETER, in mechanics, a machine for meaſuring the degree of expanſion of metals by heat.

The word is formed from the Greek, πῦρ, fire, and μετρεω, to meaſure.

There are ſeveral kinds of pyrometers, invented by different authors; but the beſt we can remember to have ſeen, is deſcribed by Mr. Ferguſon in his Supplement to his Lectures.

QUAIL, the name of a well known bird of paſſage, frequenting the corn-fields, and ſometimes the meadows. They begin to ſing in the month of April, and make their neſts in May, building on the ground.

RATSBANE, the vulgar name for arſenic. See ARSENIC.

RIBES, the currant buſh. See the article CURRANT.

ROCKET, in botany, the Engliſh name for a beautiful ſpecies of heſperis: it is a biennial plant, and increaſed by cuttings in the ſummer. It requires a ſtrong ſoil, and flowers in June: that with double flowers is moſt regarded.

RUSCUS, butchers-broom, or knee-holly, the name of a well known plant, common in the woods of various parts of England.

SNIPE, in ornithology, the name of a bird having four brown ſtreaks on the back. It is a ſmall and beautiful bird, its fleſh delicate, and much eſteemed at table.

SPARTIUM, Spaniſh broom, in botany, the name of a genus of plants whoſe flower is pentapetalous and papilionaceous; and its fruit a long cylindrical obtuſe pod, with one cell and two valves, which include a number of round kidney-ſhaped ſeeds.

TUTSAN, *Androſcemum*, in botany, the Engliſh name for a ſpecies of the hypericum. See HYPERICUM.

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